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AN INTRODUCTION TO THE PHYSIOLOGY & PSYCHOLOGY OF SEX

BY

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"THE FIRST PRINCIPLES OF EVOLUTION," ETC.

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"Through Nature only can we *ascend*."

GEORGE MEREDITH.

TO

HAVELOCK ELLIS, Esq.

PREFACE

WHILE there is a superabundance of books on sex, there exists no work for beginners which deals in plain and unmistakable language with all the essential phenomena of sex. The present book is intended to fill this gap. It tries to give the elementary facts of the physiology and psychology of sex in a simple yet scientific manner. May it help all those who so far have looked in vain for information.

My thanks are due to "THE FEMINIST CLUB" of Manchester, to whose initiative this book owes its origin.

S. H.

MANCHESTER,
March, 1917.

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INTRODUCTION

HUNGER and love are, according to the saying of a great poet, the two mainsprings of life. As the former serves the end of self-preservation, so the latter is the prime factor in securing race-propagation. But while the procuring of the material means of existence has ever been a deliberate and conscious process in the evolution of nations, the problem of the continuation of the race has hitherto been left to the blind forces of Nature. It has all been a matter of impulse and instinct. Nay, even more, the phenomena of sex have at all times been so shrouded in a veil of mystery, that an open and free approach to the sex problem has been well-nigh impossible. Though the primitive taboos connected with sex-phenomena are no longer felt in the old religious sense—as something uncanny or holy—the teaching of the last nineteen hundred years, with its emphasis on the spiritual side of man to the utter neglect of his body, has tended to keep up this half-evasive, half-ascetic attitude toward sex. Sex came to be looked upon as something " of the flesh," a necessary evil in this world. Its most sublime manifestations thus remained, except for the short spurious summer of the age of chivalry, almost wholly unrecognised and sadly neglected.

Now, it is not too much to say that sex-feeling is the motive-power of a great, if not the main part of our deeper emotional life. N ot only does it form the basis of our social institutions connected with marriage and the family, but it supplies the subject-matter of all that is best in our arts—poetry, music, drama, painting, or sculpture. Indeed, it is well-nigh impossible to conceive any of the higher arts without assuming this primal factor of love. But, leaving aside these highest manifestations of the erotic impulse, which may be considered as not germane to our subject, the more immediate manifestations of the sex-instinct require our closest attention. It will not do any longer to treat all matters of sex as unclean. The conspiracy of silence so long practised has proved an utter failure. Innocence of mind, based upon ignorance, has not brought about, as was hoped, purity of soul; on the contrary, leaving youth unguided, it has led it astray. Things thus became defiled which should have been natural, pure, and beautiful.

The only remedy for this state of affairs is instruction —that is, instruction which is based upon a proper scientific method, and which does not shirk naming facts in an unmistakable manner, however unpleasant our present associations with them may be. Only thus shall we come to appreciate the full meaning and import of the phenomena of sex. For, as Havelock Ellis has truly said: "We can never learn to reverence life until we know how to understand sex."

CHAPTER I

BIOLOGY OF SEX

It is now over half a century since Darwin established the theory of Evolution, showing irrefutably that all the higher forms of life have gradually evolved from the lower, more primitive types. This theory, now accepted by the whole scientific world, has thrown a flood of light on the problem of life. Instead of vainly trying to explain the lower stages of life in terms of the higher, as was done in pre-evolutionary times, it has now become the acknowledged method of biological science to interpret the higher by the lower, seeing that the higher, more complex organisms have their beginning in, and gradually evolve from, the lower, more simple.

It is not otherwise with the facts of sex and reproduction. To the first investigators reproduction was, as it is now to the man in the street, indissolubly bound up with the idea of sexual mating as it takes place among the higher animals. What happens to be merely an incident in the life of the higher animals and plants, the co-mingling of the two sexes for the propagation of the new generation, is looked upon as the very essence of the process. Not unnaturally so, because reproduction was at first only known in man and the higher animals. But since the life cycle of the lower, more primitive organisms has become known, and especially since the advent of the science of comparative anatomy, we have learnt to view

the process of reproduction from a different standpoint altogether.

To understand the problem thoroughly we have to begin our study with the lowest organisms, in order to see the process in its simplest form, and then follow it up gradually in its evolution from stage to stage, until it attains its highest form in the mammals, and ultimately in man.

For this purpose, it is necessary, first of all, to give a short résumé of the modern conception of the living organism—that is, of body and cell.

1. *BODY AND CELL.*

All living organisms, plant and animal, are composed of cells. The cell which forms the unit of the living being may be defined as the smallest particle of organic matter capable of life. The body consists of a mass of such units —cells various in size, shape, and function, and arranged in a definite manner. One could perhaps get an approximate idea of it by comparing it to a building constructed of bricks and stones of different sizes, colours, and materials.

The contents of the living cell—the protoplasm, as it is called—is semifluid in consistence, and generally enclosed in a limiting membrane, which forms the outer hardened layer of the cell. Within the protoplasm can be distinguished a small round body, the nucleus of the cell, which has a special structure, and is the most important part of the cell, inasmuch as it directs and regulates all the vital processes going on in the cell-body. These functions are assimilation, growth, and reproduction. The cell draws its nourishment from the surrounding medium, and works it up for its own purpose, turns it into protoplasm—*i.e.*, assimilates it. In this way the cell adds to its substance; that is, it grows. When it has attained a certain size, which varies for different cells (the average size of a cell is

always microscopical, about $\frac{1}{12}$ to $\frac{1}{250}$ inch or less), the cell divides into two daughter-cells, each with its own nucleus and cell-body—a process which will be described later on. We have thus, as the outcome of the growth of the cell, reproduction in its simplest form.

The lowest organisms, as Amœbæ and Infusorians among animals, or Bacteria and Yeast among plants, consist only of a single cell. They are called Protista—viz., Protozoa, if they belong to the animal kingdom, and Protophyta if belonging to the plants. In the next stage we find an aggregation of cells, all more or less alike in struc-

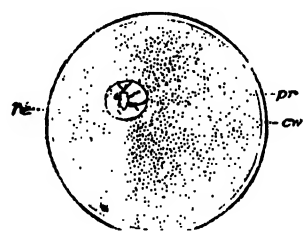

FIG. 1.—A CELL.

(*From H. W. Conn, "The Story of Life's Mechanism."*)

cw, the cell wall; *pr*, the cell substance or protoplasm; *n*, the nucleus.

ture, forming cell-colonies, as the Algæ (plants) or Volvocineæ (animals). Gradually differentiation arises among the cells; an inner and an outer layer are formed, each assuming different structure and function. As we ascend higher through the classes of animal and plant species further differences ensue; tissues and organs are formed for specific purposes with specialised anatomical structure, until we reach the highest stage in the mammals, and finally in man. All organisms composed of many cells are called Metazoa and Metaphyta, in distinction from Protozoa and Protophyta respectively. However great

the difference between the lowest and highest organisms may be, there is this one fundamental agreement: they all are made up of cells, variously arranged and variously adapted in structure and function for their specific purpose.

As we can follow step by step the gradual evolution of the higher types of organisms from the lower by the agglomeration and gradual differentiation of cells, so we can trace a parallel development in the growth of each single individual. Every animal or plant starts life as a single cell. This mother-cell divides and redivides, forming a mass of cells, which gradually differentiate into layers, tissues, and organs, finally to build up the complete body in all its complexity. The construction of the body, then, from the first mother-cell to its final size and form, is thus due to a continuous reproduction of cells. The growth of each part of the body is kept up by the multiplication and addition of cells arising from the old cells already present. In fact, growth, as we see, is nothing but a process of reproduction of cells. As long as the organism grows, the material for the additional growth is supplied by the old cells, which divide to form the new ones.

But, at the same time, with this process of growth and building up of the body another process is going on in the organism—a gradual wearing down and simultaneous renewal of the worn-out parts of the body. Cells grow old, die, and are replaced by new ones. This process is a very familiar one. Everybody knows that skin, hair, and nails are periodically renewed under normal conditions. The small scales of the skin which are regularly thrown off are nothing else than old dried-up cells, which, if in excess, form on the head the well-known dandruff. Hair, which is nothing but a cylinder of cells, falls out regularly, and is replaced. The moulting of birds, snakes, crabs, etc., is a well-known phenomenon. There is every reason for

assuming that the other cells in the different organs of the body are also periodically renewed, as we know that the mucous linings of mouth, intestine, etc., shed their cells regularly.

We recognise, then, a constant process of regeneration of the body-cells as a normal physiological function. If the gradual decay of cells is not sufficiently made up by new ones—if, as it is scientifically expressed, during the process of Metabolism* the upbuilding process (Anabolism) is outweighed by the breaking-down process (Katabolism)—the body wastes away and finally dies.

Senile decay and natural death are nothing but the expression of the excess of katabolic changes in the body over anabolic changes.

2. *REGENERATION.*

In addition to these phenomena of life and growth, where a process of what may be called physiological regeneration is involved, we find the organism endowed with a still greater power—that of regenerating whole parts of the body under exceptional circumstances. It is this capability to replace lost parts of the body *in toto* which is generally comprised under the name of Regeneration proper.

It is a well-known fact of daily life that a wound heals; a defect in the skin, due to an accident, is rapidly repaired. What is this healing process? Nothing but a process of cell-regeneration, akin to the one described above. What happens is this: The cells in the neighbourhood of the injury are stimulated to activity; they propagate, multiply, and speedily fill up the gap with young cells, each kind of cell regenerating its own kind. This, within

* Metabolism is the process of assimilation in the body, by which the food taken into the body is changed and worked up into the organic substance of the cell.

certain limits, is the process involved, whatever may be the part of the body concerned—within certain limits only, because the repair is not always complete. The higher the organism and the greater the differentiation of its cells, the less capable these become, after completely attained growth in the adult body, of reproducing themselves in mass. The possibility of regeneration depends largely on the organisation attained by the species concerned. It is for this reason that we find the phenomena of regeneration exhibited to the fullest extent among the lower animals. Here not only small tracts of particular tissues can be renewed, but whole parts of the organs of the body. The most familiar example is perhaps the well-known case of the lizard, which easily re-grows its broken-off tail; or of the triton, which will replace a whole leg that has been lost. The crab has the power of growing a new claw in place of that lost in a fight with its rival, one kind actually snapping its own leg when caught. The snail is able to renew its eye, together with the eye-bearing horn. Still lower in the scale, we find the starfish adding an arm that has been lost, or the sea-cucumber its ejected viscera.

But we are not yet at the end of the regenerative power of Nature. Besides the accidental losses enumerated above, which are easily made good again, we may go farther, and actually divide some animals into several pieces without any detriment to their existence. On the contrary, the separated parts live on, re-create the missing parts, and become fully equipped individuals once more. Instead of a loss of life, we have a multiple gain of it.

Of these cases the most familiar example is the common earthworm, which, when divided, grows into two complete animals, each divided part regenerating the missing portion of the body. The hydra-polypes, the sea-anemones, the Planaria worm, may be cut into many

pieces, and each piece will grow again into a new complete individual. To take cuttings and slips from plants is a very common device of the gardener for multiplying his stock. Even the smallest particle of a Begonia leaf will grow into a complete plant again.

We have thus reproduction of parts of the organism up to any extent, the remaining cell-complex always making up the missing part by vigorous multiplication. After all, it is not more wonderful that the same cells which grew, let us say, into a limb during the individual development

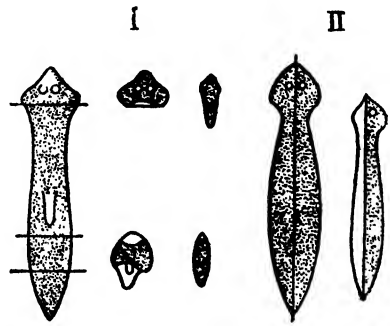

FIG. 2.—REGENERATION OF A PLANARIAN. (After Morgan.)
(*From Weismann, "The Evolution Theory."*)
I, transverse, II, longitudinal division.

of the embryo should be able, if need be, to perform the same feat again.

When we come to such cases as the Begonia leaf, where we find the tiniest particle will reproduce the whole plant, we are not very far from reproduction proper. Regeneration may be said to be reproduction of a part of the body, while reproduction proper is of the whole body.

Now, we have seen that regeneration itself is nothing else than new growth proceeding from the old cells, and there will therefore at this stage of our inquiry be nothing

startling in the statement of Herbert Spencer that "Reproduction is discontinuous growth."

This will be still better understood after studying reproduction itself in all its phases.

3. *REPRODUCTION.*

It was pointed out at the beginning of this chapter that the first misunderstanding to be cleared up with regard to reproduction is the popular idea that reproduction means sexual mating. This will at once become apparent from the fact that there are numerous classes of low organisms which are sexless, and in which reproduction can accordingly only be asexual. The only element discernible in the process of reproduction is here, clearly, nothing else than the propagation of the species.

(*a*) Asexual Reproduction.

If we now turn to the cases of asexual reproduction, we find them chiefly among the lower classes of organisms. It is the ordinary method of propagation among the one-celled plants and animals. But it is by no means restricted to them, as we find asexual reproduction as high up in the animal kingdom as the worms and tunicates (sea-squirts), and as a regular occurrence in the branching of flowering plants.

We can distinguish three kinds of asexual reproduction: Division, Budding, and Sporulation.

Division.

The simplest process of division we find in the one-celled organisms. Here—as, *e.g.*, in the Amœba or Infusorian—we have a single cell, which, after attaining a certain size, divides into two daughter-cells. This process starts with

the nucleus, which elongates, becomes dumb-bell-shaped, and finally breaks up into two halves. The contents of the cell-body follow suit, the latter becomes indented, and, by surrounding the two newly formed nuclei, brings about the formation of two separate individual daughter-cells. This process of division, which is called "Amitosis," shows clearly that reproduction as just described

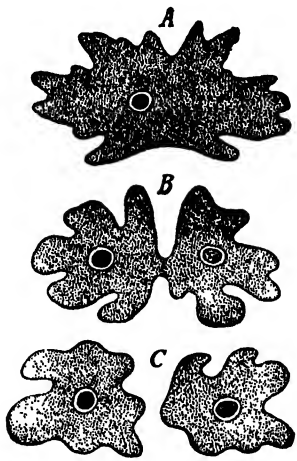

FIG. 3.—DIVISION OF AMŒBA.

(*From Weismann, "The Evolution Theory."*)

A, before division; *B*, the nucleus divided; *C*, the daughter amœbæ.

is nothing but the outcome of growth. The single mother-cell, becoming too large for carrying on the process of nutrition, simply splits up into two constituent halves, which, as it were, are a continuation of its own existence.

This process of simple fission is the most common method of propagation among the Protozoa and Protophyta, but it can also be observed in species of higher organisation, even as high up as the worms.

Thus we find among the Polypes some which multiply by division; the newly formed individuals, however, do not separate, but remain attached to each other, thus forming what is called a Polype-stock.

Among the worms, we have the Bristle-footed worm (*Chætopoda*), which, either normally or on a shock, breaks up automatically into several pieces. The sea-worm

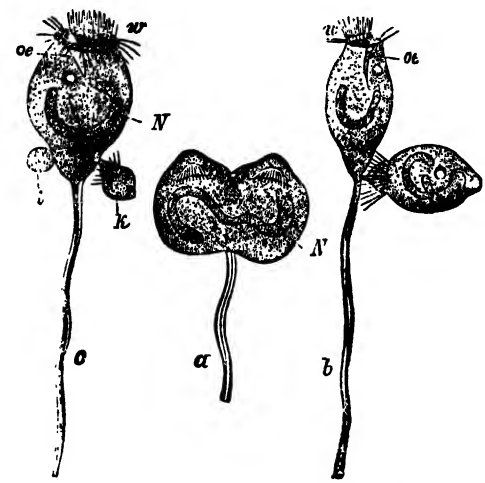

FIG. 4.—VORTICELLA MICROSTOMA. (After Stein.)
(*From Claus, "Textbook of Zoology."*)
a, division; *b*, division completed; *c*, conjugation with small attached individual (*k*); *N*, nucleus; *oe*, gullet; *w*, cilia.

Myrianida forms, when dividing, a whole chain of young worms. In both these cases it is evident that after the division of the mother-animal the completion of the daughter-worms must take place by regenerating the missing portion of the body, either fore or hind end, or both. Here, too, we can still trace the close connection between the process of reproduction on the one hand and that of growth and regeneration on the other.

Budding.

While in division, as just described, the whole mother-organism enters into the formation of the respective parts of its progeny—the parent-animal thus being lost in, or

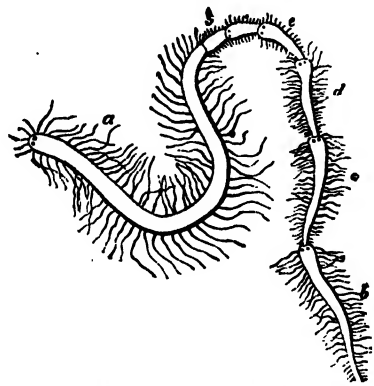

FIG. 5.—DIVISION OF MYRIANIDA, A MARINE WORM. (After Milne-Edwards.)

(*From Weismann, "The Germ-Plasm."*)

a, mother-worm; *b* to *g*, the daughter-individuals according to their relative ages.

rather merged into, its own descendants—in budding the new offspring takes its origin only from a relatively small part of the mother-organism. The entity of the mother-

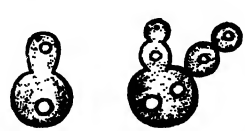

FIG. 6.—BUDDING OF YEAST. (After Prantl.)

organism thus remains unimpaired and distinct from the daughter-organism. It is at this stage that we can speak for the first time of a parental relationship between the

generations, seeing that we have the parent originating the offspring from a part of its own body, leading to a distinct and independent existence of the offspring. Yet, as can be seen at a glance, the original connection with mere physiological growth of the body is still a very close one. The parent-body, whilst in the process of growing, bulges out its contents at a particular point, and the "bud" thus formed becomes the starting-point of the new offspring.

The common yeast (a one-celled plant organism) is a very typical example.

FIG. 7.—BUDDING OF SPONGE COLONY. (After Haeckel.)
(*From Geddes and Thomson, "The Evolution of Sex."*)

Budding as a means of reproduction is more frequent than division, and can be found in all lower classes of animals, right through the Sponges, Corals, Polypes, etc., up to the Worms and Tunicates.

Very often the new individuals arising from the buds do not separate from the parent body, but, remaining attached to it, and budding off further individuals in all directions, form a ramifying conglomeration of animals, the animal-stock.

Typical examples are the Sponges, Corals, and Hydra-polypes. Something similar can be seen in the marine worm *Syllis ramosa*.

Among the higher plants reproduction by budding is a regular occurrence. In fact, all the flowering plants propagate, in addition to the sexual way by means of flowers and seed, in an asexual manner by budding; for every shoot and branch of the plant must be looked upon as a distinct, asexually produced individual. In reality, a

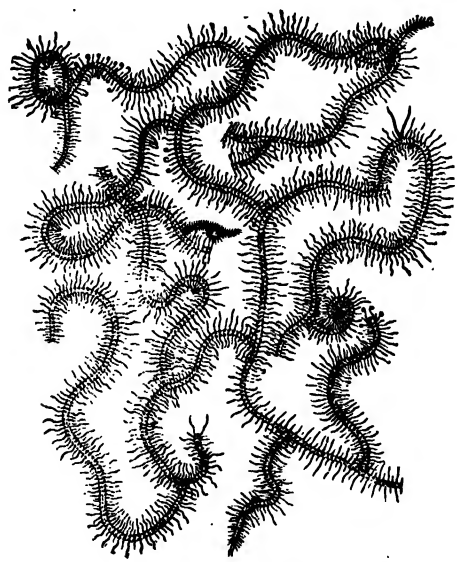

FIG. 8.—BUDDING OF SYLLIS RAMOSA, A MARINE WORM. (*From Geddes and Thomson, "The Evolution of Sex."*)

flower-bearing branching plant must be compared to the ramified animal-stock; it is, indeed, a multiple individual, a "plant-stock."

Sporulation.

In sporulation we have special cells of the body set aside for reproduction, which, after detaching themselves from the mother-organism, produce the new progeny. These

cells may already be called germs in the proper sense, but they differ from the real germ-cells in this respect—that they are sexless.

Sporulation is chiefly to be found among the lower plants —Algæ, Mosses, Ferns, etc.—and in a few kinds of Protozoa. In some cases—as, *e.g.*, in the Infusorian *Euglena* —the whole contents of the original organism, after be-

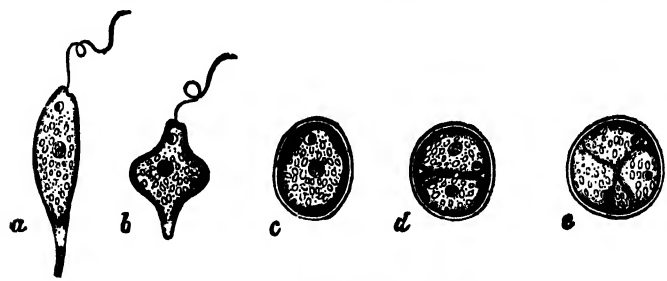

FIG. 9.—EUGLENA VIRIDIS.

(*From Claus, "Textbook of Zoology."*)

a and *b*, free swimming in different states of contraction; *c* to *e*, encysted and in process of division.

coming encysted, break up into a mass of spores, which, bursting the mother-shell, swarm freely about as the new young individuals.

(*b*) CONJUGATION.

Conjugation, which means the union of two separate individuals for the purpose of propagation, gives us the true connecting-link between asexual and sexual reproduction. The transition between these is very gradual—so much so that we may trace every stage from the union of two organisms completely alike in every respect up to the true sexual mating of distinct male and female in the higher animals.

We have, to begin with, two (or rarely more) individuals

of the species (as in Algæ or Infusorians) simply mingling their combined bodies into one, and thereafter multiplying by simple division in the ordinary manner. In the Bell-animalcule (*Vorticella*), mentioned once before, conjugation takes place between the large mother-animal and one of the much smaller progeny, which has resulted from repeated divisions (see Fig. 4, *c*). In the Alga *Zanardinia* the two conjugating cells are already of widely

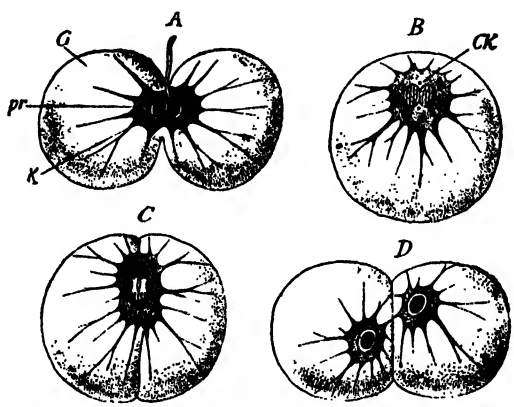

FIG. 10.—CONJUGATION OF NOCTILUCA. (After Ischikawa.)

(*From Weismann, "The Evolution Theory."*)

A, two individuals coalescing; *B*, fusion of cells; *C*, beginning of division; *D*, completion of division; *pr*, protoplasm; *K*, nucleus; *G*, cell-body, *CK*, centrosome.

divergent character, approaching in type the bulky female and minute active male germ.

Further, that conjugation means more than mere fusion and consequent separation of the cell-substance of the two individuals concerned can be seen in those cases where, as in the Infusorian *Paramœcium caudatum*, an exchange of nuclei can be clearly demonstrated between the two conjugating animals. The two bodies, after closely ap-

proximating to each other, send each a nucleus across to the other. Evidently the purpose of conjugation seems to be the mixture and exchange of the qualities of the two parents, and their redistribution among the offspring. We can therefore regard this process as the last link

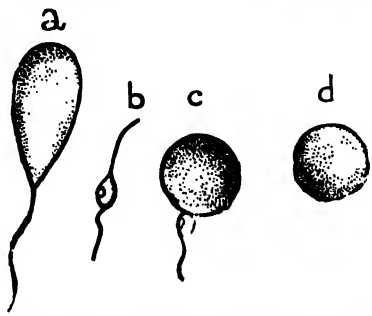

FIG. 11.—CONJUGATION OF ZANARDINIA. (After Reinke.)
(*From Delage, "Hérédité."*)
a, female; *b*, male; *c*, conjugation; *d*, product of conjugation.

leading up to real "Amphimixis"—*i.e.*, the mixing of parental qualities for the production of progeny.

(*c*) SEXUAL REPRODUCTION.

It has become evident from what has gone before that amphimixis, or the co-mingling of the sexes, is *not* the essential element in the process of reproduction. Reproduction, which, as we have seen, can be carried on by a single individual, and is only gradually delegated to two differentiated sexes, has the one object—that of the propagation of the species. We must therefore look upon this as the main function of sexual reproduction also.

We may conveniently deal with sexual reproduction under four heads: Heterogamy, Autogamy, Parthenogenesis, and Alternation of Generations.

Heterogamy.

Heterogamy means reproduction by union of differentiated male and female individuals. This is, of course, the best known, because made familiar to us by its occurrence in all higher animals and man. Here we have the union of the separate male and female organisms, in order to produce the new progeny. Among the Protistes the fusion takes place bodily, as described under Conjugation; but with Metazoa and Metaphyta this would

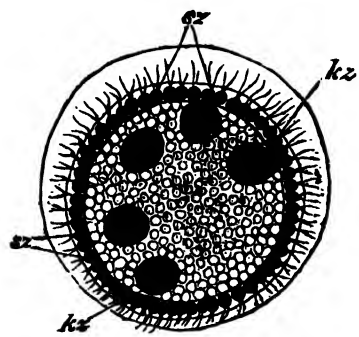

FIG. 12.—VOLVOX MINOR. (After Stein.)
(*From Weismann, "The Germ-Plasm."*)
sz, body-cells; *kz*, germ-cells.

evidently be impossible. Now, we have seen already in the evolution of asexual reproduction that distinct parts of the body may be set aside for the purpose of propagation, as in sporulation, where the spores may be looked upon as asexual germ-cells. A similar process of differentiation between body and propagating germ-cells takes place among the Metazoa. We can see this illustrated beautifully in the Volvox, which may be described as a cell-colony of one-celled animals. Here some of the uniform body-cells become distinct from the others,

and develop into sex-cells, these alone being able to reproduce the species.

As the ultimate outcome of this process we find, on the one hand, a parent-organism, and within the body of that parent definite cells—the germ-cells—from which the development of the new progeny takes its origin. In the highest form each parent organism forms germ-cells of a definite kind, either male or female, the union of both

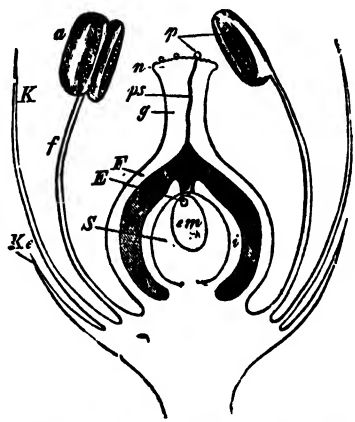

FIG. 13.—DIAGRAM OF A FLOWER. (After Prantl.)

Ke, calix; *K*, corolla; *f*, stamen; *a*, anther with pollen *p*; *F*, ovary; *g*, pistil; *S*, ovule; *em*, embryo sac, with embryo *E*; *i*, integument of ovule.

these germs being essential for the procreation of the new generation.

Among plants we find male and female germ-cells in all flowering species—the former, the pollen-grain, being developed in the anther of the stamen of the flower; the latter, the ovule, lying in the ovary, to which the pistil leads. Most flowers possess both sexual organs, stamen as well as pistil; but many flowers are uni-sexual, having either stamen only or pistil only. When uni-sexual

flowers of both kinds, male and female, are to be found on the same plant, the plant is said to be " mon-œcious "

FIG. 14.—CATKINS OF HAZEL.
(*From Oliver, " Elementary Botany."*)
♂ male, ♀ female flowers.

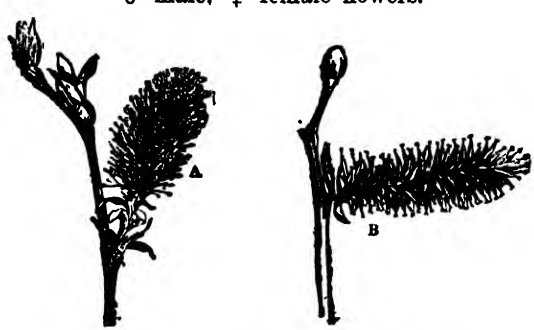

FIG. 15.—CATKINS OF WILLOW (SALIX).
(*From Oliver, " Elementary Botany."*)
A, male; *B*, female.

(as oak, alder, hazel); when male and female flowers are on different plants, such plants are " di-œcious " (as in the willow).

In the higher animals the female germ-cell is called the egg-cell or ovum, while the male germ-cell is known as the spermatozoon.

Autogamy.

While in Heterogamy we have the union of two distinct individuals—that of a male with a female—in Autogamy the organism, as it were, mates itself, both kinds of sex-cells being present within the same individual. Such individuals, being male and female at the same time, are known as Hermaphrodites.

Hermaphroditism is, as already mentioned above, a very common occurrence in flowering plants, most flowers containing pistil as well as stamen.

In animals it is less frequent, but by no means rare. It occurs normally in Sponges, Corals, Worms, Snails, etc. Even the higher animals, including man, pass through a fœtal stage when both sex-organs, male and female, are still existent; but only one of them in the course of development reaches its full form and function. As a pathological curiosity, this embryonic stage may persist in the adult.

We find that even when both kinds of germ-cells are present in the same individual self-fertilisation is by no means the rule. On the contrary, as Darwin has shown in plants (and something similar holds good for animals), most ingenious contrivances are set up to insure cross-fertilisation—*i.e.*, fertilisation of one individual by another.

Parthenogenesis.

Parthenogenesis, which was discovered in 1745 by Bonnet in the plant-lice, is the power which certain female animals possess of producing offspring without sexual union with the male—*i.e.*, without fertilisation.

The case of the bee is a well-known example of partial

Parthenogenesis. The queen-bee, who is impregnated only once in her life—during her nuptial flight—lays two kinds of eggs: one kind, which are fertilised by the queen-bee with the stored-up sperm, become workers or a queen; while the other kind, not fertilised, become drones. Seasonal Parthenogenesis is to be found among water-fleas (minute aquatic Crusters—*Cladocera*) and the plant-lice, or *Aphides*. Here we have a succession of virgin-births during summer, but males generally reappear towards autumn, and with them the ordinary sexual reproduction. Lastly, in some minute aquatic Crusters and many Rotifers (water-worms) no males have ever been found. Propagation must therefore take place altogether without males, thus giving us the phenomenon of total Parthenogenesis.

Seeing that parthenogenetic reproduction is by no means rare, and that the number of such offspring is abundant, it becomes once more evident from these facts that sexual union is by no means essential for the propagation of life.

Alternation of Generations.

We have just described the occurrence of parthenogenetic females in plant-lice during summer which alternate with the sexual generation, males and females, of the autumn. As the summer breeds differ from the autumn breeds, we have here a true case of alternation of generations. In the cited instance sexual generations alternate with parthenogenetic ones. But the succession may be between sexual and asexual generations, the latter propagating by division, budding, or sporulation.

The former case is illustrated by the Hydra-polypes and the common jelly-fish (*Aurelia*). In both these instances we find free-swimming sexual individuals pro-

ducing a sessile generation, which is asexual, and produces in its turn, either by division (*Aurelia*) or by budding (Hydra-polype), once more the sexual free-moving generation.

The interpolation of asexual reproduction by spores

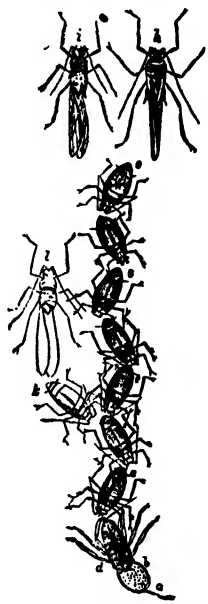

FIG. 16.—ALTERNATION OF GENERATIONS IN PLANT-LICE.

(*From Geddes and Thomson, "The Evolution of Sex."*)

At the base is an individual arising from a fertilised egg-cell; this gives origin parthenogenetically to a succession of generations. At the top are shown the male and female forms, which ultimately reappear. At the side an earlier reappearance of sexual forms is suggested.

between sexual generations is a well-studied phenomenon among lower plants. In the ordinary Fern we have the big fern-leaf, the asexual plant, producing the familiar spores at the back. These develop when in suitable

ground into an inconspicuous green organism, with male and female sex-cells. From the union of both arises once more the tall fern-plant. In the Moss we have a similar process, but in this case the sexual plant is the more conspicuous one. The higher flowering plants all exhibit a

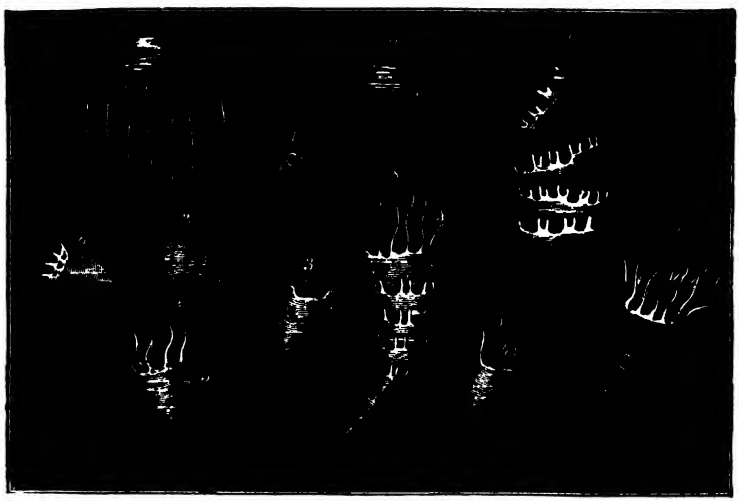

FIG. 17.—ALTERNATION OF GENERATIONS IN THE COMMON JELLY-FISH (AURELIA). (From Haeckel.)

(*From Geddes and Thomson, "The Evolution of Sex."*)

1, free-swimming embryo; 2, embryo settled down; 3 to 6, the developing asexual stage; 7 and 8, the formation of a pile of individuals; 9, their liberation; 10 and 11, the free-living sexual form.

sort of alternation of generations, inasmuch as the plant first throws off branches—*i.e.*, individuals arising by the asexual process of budding—which in their turn produce sexual flowers. But here the sexual generation never becomes really independent, remaining more or less a part of the asexual organism.

CHAPTER II

PHYSIOLOGY OF SEX

For one who is accustomed to look upon biology from the modern point of view, it is almost an impossibility to revert to the state prevalent at the time when the cell as the unit of the organism was unknown. And yet it was only in 1838 that Schleiden for the first time demonstrated the cell-structure of plants, showing that plants were not only built up of cells, but also took their origin from a single cell, the ovum. The same was proved by Schwann in the following year, 1839, to apply to the animal kingdom. Up to then cells had occasionally been seen with the microscope, but, as the name implies, they had been looked upon as "cells"—*i.e.*, cavities filled with air. Only gradually were they recognised to be solid bodies having contents, protoplasm and nucleus. It was only after the discoveries of Schleiden and Schwann, and the application of the cell-theory to the whole range of biological facts, normal as well as pathological, that a real science of life became possible.

The chick had gradually been traced back (by Harvey, 1651, Malpighi, 1672, and others) to its real starting-point—the vital part within the hen's egg; but it was as late as 1828 that Von Baer discovered the ovum of the mammals. It was much later still—in 1861—that the German zoologist Gegenbaur finally demonstrated the fact that the egg of every vertebrate is a single cell, the

same being subsequently shown to hold good for that of invertebrates and plants also.

The male sex-element of the higher animals, not being permanently hidden within the body, as is the egg-cell, was discovered very much earlier—in 1677. But here the central fact was at first missed altogether: the seminal fluid was thought to be the important element, while the spermatozoon was looked upon, as the name implies, as a parasitic animalcule. It was only much later that the presence of spermatozoa was found to be the essential factor in fertilisation, and not till 1841 did Kölliker demonstrate its cellular origin in the male sex-glands, the testes.

1. *THE GERM-CELLS.*

It is, then, a fundamental fact that both germ-cells, the ovum as well as the spermatozoon, are single cells, possessing all the qualities of such, and behaving in their fundamental functions like cells. These we are now going to study more in detail.

We have already explained that each cell possesses a nucleus, which is the most important part of the cell. This nucleus has a limiting membrane, and is filled with a network of a substance called Linin, while on this network is arranged the Chromatin, so called because it is easily colourable with artificial stains. On this chromatin has been centred the greatest interest, because it is the substance which has to be looked upon as the bearer of the hereditary qualities of the cell, and therefore of the organism. Apart from other arguments, which will appear later, this becomes evident from the rôle the chromatin plays in the division of the cell. This division, which goes by the name of Mitosis or Karyokinesis, takes place in a most regular and exact manner, and serves the purpose of dividing the chromatin substance into two equal parts.

Starting with the resting phase of the cell, before it begins to divide, we see the arrangement of the nucleus with its chromatin, as just described, and in it a little body, the nucleolus, the function of which has not yet been elucidated. Just outside the nucleus lies the small centrosome, destined to play an important part in the process of division.

The first stage of the division is initiated by a re-

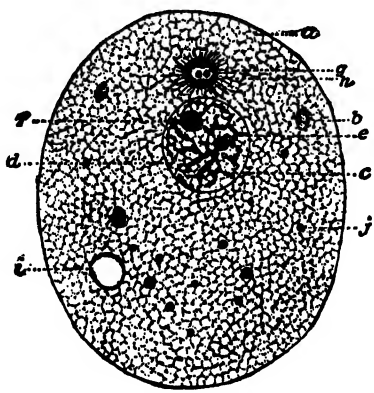

FIG. 18.—A CELL.

(*From H. W. Conn, "Story of Life's Mechanism."*)

a, protoplasmic network; *b*, liquid contents; *c*, nuclear membrane; *d*, nuclear network; *e*, chromatin network; *f*, nucleolus; *g*, centrosome; *h*, aster; *i*, vacuole or air-space; *j*, inert bodies.

arrangement of the chromatin into a long thread, which immediately breaks up into a number of small pieces, called the Chromosomes. The number of these chromosomes is the same for all ordinary cells of the organism, and does not vary within any given species. At the same time, the centrosome, which lies just outside the nucleus, has divided into two, each new centrosome becoming surrounded by radiating fibres, which give it a star-like

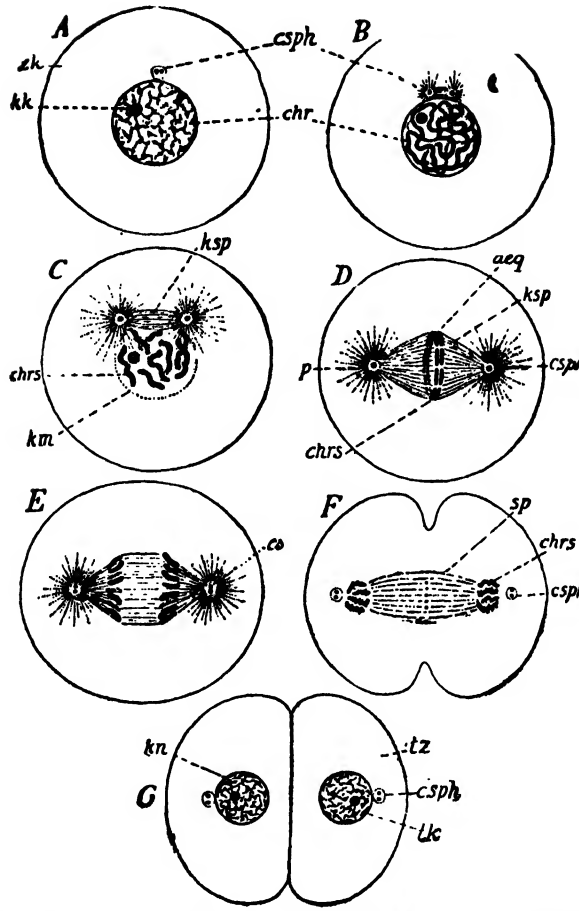

FIG. 19.—KARYOKINESIS. (Adapted from E. B. Wilson.)
(*From Weismann, "The Evolution Theory."*)

A, resting-phase; *B*, chromatin (*chr*) in coiled thread; *C*, eight chromosomes (*chrs*) and two asters formed; *D*, chromosomes split and lying in equatorial plane, the two centrosomes (*csph*) at the poles; *E*, chromosomes separate; *F*, division of cell-substance; *G*, final formation of two daughter-cells; *ek*, cell-substance; *kk*, nucleolus; *km*, membrane of nucleus; *aeq*, equatorial plane; *ksp*, radiating fibres.

appearance; hence the name "aster." The centrosomes now separate, each wandering through a quarter of a circle into the opposite direction, the radiating fibres stretching between them. There seems to be no doubt that the centrosome, with its asters, exerts the determining influence in the division of the nuclear contents.

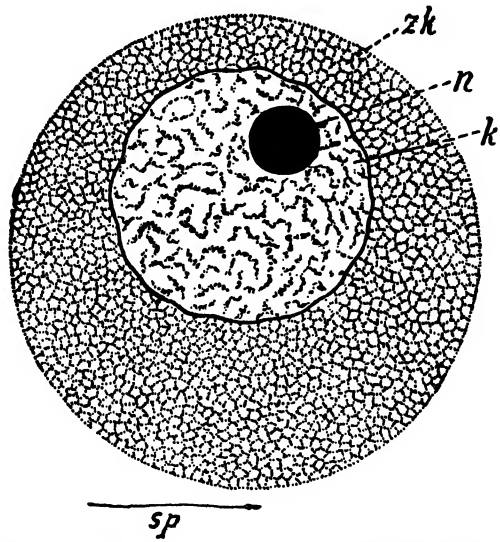

FIG. 20.—OVUM OF SEA-URCHIN, TOXOPNEUSTES LIVIDUS (After Wilson.)

zk, cell-body; *k*, nucleus; *n*, nucleolus. Below the ovum the spermatozoon (*sp*) of the same animal is drawn with the same magnification.

Meanwhile the limiting membrane of the nucleus has disappeared, and the chromosomes have arranged themselves in the equatorial plane between the two asters. The next step effects the halving of the chromosomes. Each of the chromosomes splits up, not across the middle, but *lengthwise*, so that instead of each single chromosome

we get now a pair of them lying alongside each other. We have, therefore, at this stage a double set of chromosomes, one lying close to the other in the equatorial plane. These two sets next separate from each other by moving to the opposite poles towards the centrosomes, each set thus forming a new daughter-nucleus. Finally, the chromosomes lose their thread-like appearance, form again a network, and surround themselves with a new

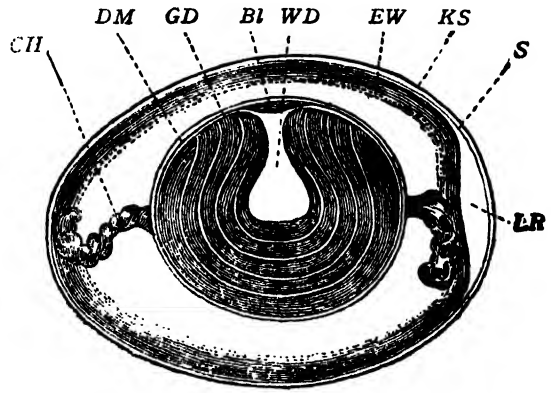

FIG. 21.—HEN'S EGG: DIAGRAMMATICAL LONGITUDINAL SECTION. (After Allen Thomsen.)

(*From Weismann, "The Evolution Theory."*)

CH, chalaza; *DM*, vitelline membrane; *GD*, yellow yolk; *Bl*, germinal disc with germinal vesicle; *WD*, white yolk; *EW*, albumen; *KS*, shell; *S*, shell membrane; *LR*, air-chamber.

membrane. As, meanwhile, the cell-substance also has divided, we have at last two complete daughter-cells, each exactly the same as the mother-cell with which we started. We see, in fact, that this process of division effects the exact halving of the chromatin substance, so that each daughter-cell receives not only the same number, but also the same kind of chromosomes as the mother-cell had.

(*a*) Ovum.

Coming now to the description proper of the germ-cells, we shall start with the Ovum.

The ovum is a cell, and has as such the typical cell-structure. It has a cell-body, limited by a cell-membrane, and, further, a nucleus, here called the germinal vesicle, which again contains the nucleolus and the chromatin substance.

The size of the ovum varies considerably. It is often microscopical, as in the mammalian eggs, but can attain,

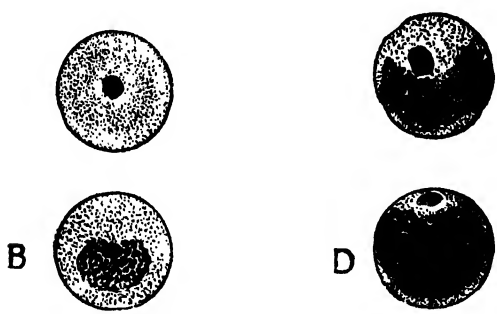

Fig. 22.—Ovum and Disposition of Yolk. (After Thomson.)
A, ovum with diffuse yolk (sponge); *B*, ovum with central yolk (crayfish); *C*, ovum with polar yolk (frog); *D*, ovum with predominant yolk (bird).

on the other hand, enormous proportions, as in the case of birds. The essential part of the egg-cell, however—the nucleus—is always small, generally visible only with the aid of the microscope, the remainder of the egg being made up by various extrinsic additions, chiefly the yolk. The latter consists of material stored up within the egg to serve the forthcoming embryo as nourishment. We can see how the large size of the bird's egg, *e.g.*, is mostly made up by the yolk, which lies around the very minute germinal vesicle.

According to the disposition of the yolk within the egg, we distinguish four types of eggs, each of which is characterised, as we shall see later, by a typical method of segmentation. We have eggs with (1) diffuse yolk, where there is a small amount of yolk evenly distributed throughout the egg-cell, as in Invertebrates (Sponges, Corals, Starfish, Worms, etc.) and Mammals; (2) central yolk, the yolk being in the centre of the egg, as in Arthropods (Crusters, Insects); (3) polar yolk, a large proportion of yolk, accumulated chiefly in the lower half of the egg, as in Amphibians (Frog); and, finally, (4) predominant yolk, where nearly the whole egg is taken up by the yolk, except a tiny part at the upper pole of it, as in Fishes, Reptiles, and Birds.

FIG. 23.—SPERMATOZOON. (After Wilson.)

(*From Weismann, "The Evolution Theory."*)

sp, point;
n, nucleus;
c, centrosome;
m, middle-piece;
ax, tail.

(*b*) SPERMATOZOON.

The Spermatozoon is, as a rule, very much smaller than the corresponding ovum. Its form is adapted to its function, for it actively seeks and penetrates the ovum.

The typical spermatozoon—as, *e.g.*, in man—consists of a small pointed head, composed almost entirely of the nucleus, a middle-piece, containing the centrosome, and a long contractile tail, by means of which the spermatozoon effects its rapid undulatory movements. The shape in other cases may differ, be star-like or club-like, but the active amœboid movements are an essential feature of it.

(c) Maturation and Spermatogenesis.

Both germ-cells, ovum as well as spermatozoon, possess the same number of chromosomes as the ordinary body-cells, which, as has already been remarked, is constant for any given species. Before, however, the germ-cells are ready to unite in the act of fertilisation, they undergo certain changes, which have the effect of leaving them

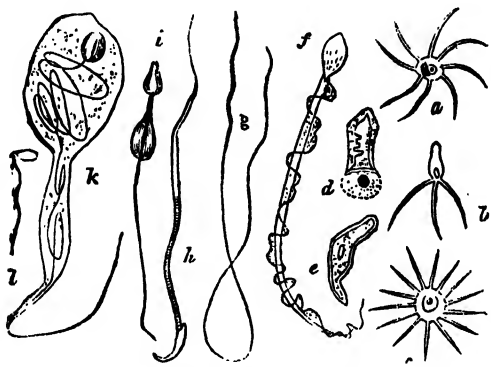

Fig. 24.—Spermatozoa.

(*From Geddes and Thomson, "The Evolution of Sex."*)

a, crayfish; *b*, lobster; *c*, crab; *d*, ascarid; *e*, water-flea—*Moina*; *f*, man; *g*, ray; *h*, rat; *i*, guinea-pig; *k*, beetle—immature stage; *l*, sponge.

with only half the number of chromosomes they had previously. This process in the ovum is called its maturation, while the same end is achieved for the spermatozoon during its development—*i.e.*. during the process of spermatogenesis.

Maturation.

In 1875 Bütschli showed that the small polar bodies, which had been observed outside the ovum as far back as

1824, resulted from the division of the egg-nucleus itself. After it had further been established in 1883 by E. van Beneden for the round-worm of the horse (*Ascaris megalocephala*), and later for most other animals and plants, that the sex-nuclei of ovum and spermatozoon contain only half the number of chromosomes that are characteristic for the cells of the parent-body, the connection between these two phenomena became gradually cleared up, so that Weismann was finally enabled to formulate his now generally accepted view, that the maturation of the ovum has no other purpose than to effect the reduction of the chromosomes to half their original number.

But this reducing division is not so simple as just suggested, because, before the reduction of the chromosomes, a doubling of them first occurs, so that, in order to get ultimately the reduced number, the division has to take place twice.

We have, to take an instance, an egg-cell with four chromosomes before maturation. This egg-cell, as it ripens, grows larger, and doubles its number of chromosomes, having now eight instead of four. Now, in the first instance, half the number of these eight chromosomes—*i.e.*, four—are removed from the mother egg-cell by a process of division, as described above under the heading of karyokinesis. But here there are to be noted two differences from the ordinary division. Firstly, the two daughter-cells resulting from the division are of very unequal size, the larger one remaining as the ovum proper, while the smaller one forms the first polar body, which thus comes to lie outside the ovum. The second difference is this: that each of the two daughter-cells does not receive, as happens in the regular karyokinesis, the same number of chromosomes as the mother-cell. Indeed, no splitting up of the chromosomes lengthwise takes place for that purpose, but each daughter-cell receives only half

the original number of chromosomes—*i.e.*, in our case, as the ripe ovum had eight chromosomes, the ovum and the first polar body have after the first division four chromosomes each. But now a second division is

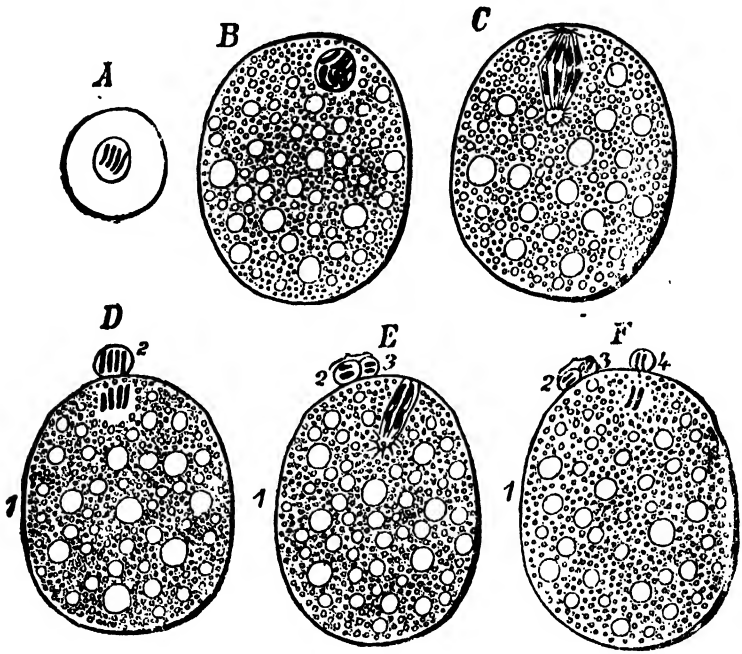

FIG. 25.—MATURATION OF OVUM.

(*From Weismann, "The Evolution Theory."*)

A, primitive ovum with four chromosomes: *B*, mother egg-cell with eight chromosomes; *C*, first maturation-division; *D*, formation of first polar body (2); *E*, second maturation-division and division of the first polar body into two (2 and 3); *F*, formation of second polar body (4).

necessary, in order to reduce the number of chromosomes still further to half the original number of the primitive ovum, which had four chromosomes. This takes place in

the same manner as just described for the formation of the first polar body. The remaining chromosomes of the ovum divide again, two now remaining finally in the ovum, and two forming a new polar body. As the first polar body also has meanwhile divided into two, each with two chromosomes, we have as the final product of maturation the ovum with two chromosomes (being half of the original number) ready for fertilisation, and three polar bodies, each with two chromosomes. The polar bodies,

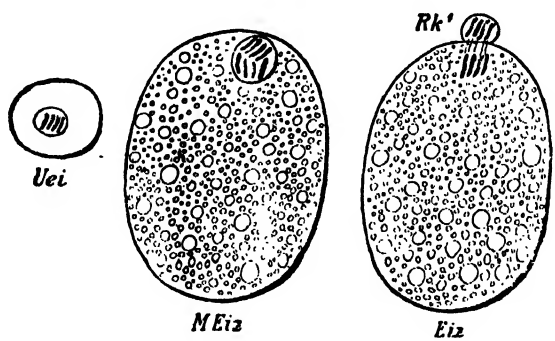

FIG. 26.—MATURATION OF PARTHENOGENETIC OVUM.

(*From Weismann. "The Evolution Theory."*)

Uei, primitive ovum with four chromosomes; *MEi2*, mother egg-cell with eight chromosomes; *Ei2*, formation of one polar body (*Rk*[1]).

so far as our present knowledge goes, seem to be functionless, and are lost. The accompanying illustration (Fig. 25) will make the process still clearer.

The parthenogenetic ovum, as has now been abundantly proved, divides only once for maturation—that is, it first doubles its number of chromosomes, and then extrudes only one polar body, thus retaining the full original number of chromosomes.

Spermatogenesis.

The observation of the reducing division in the ovum suggested to biologists to look for a similar process in the male germ-cell. This process was actually found to occur, but it is here slightly different from that in the ovum; for

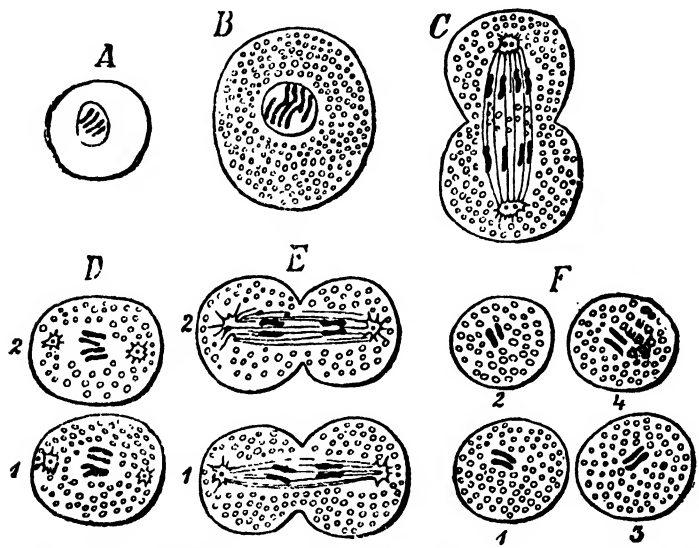

FIG. 27.—SPERMATOGENESIS. (Adapted from O. Hertwig.)

(*From Weismann, "The Evolution Theory."*)

A, primitive sperm-cell with four chromosomes; *B*, mother sperm-cell with eight chromosomes; *C*, first maturation-division; *D*, formation of first two daughter sperm-cells; *E*, second maturation-division; *F*, final four sperm-cells.

while the ovum rids itself of half its chromosomes during its maturation, the halving of the chromosomes in the sperm-cell takes place earlier, during the process of its formation —*i.e.*, during spermatogenesis. Furthermore, while the products of the reducing division of the ovum are, as we

have seen, of unequal size, the three small polar bodies being cast away, in spermatogenesis all the resulting cells are of equal size, and capable of functioning. Otherwise the two processes are in every respect alike. We have a

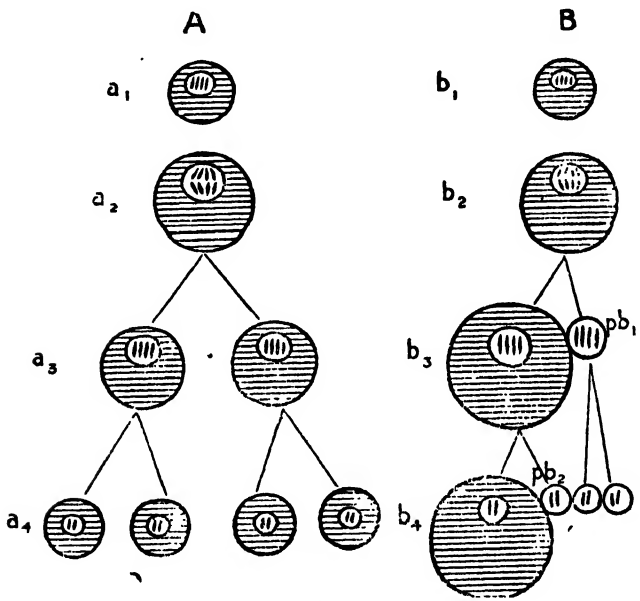

FIG. 28.—SPERMATOGENESIS AND MATURATION OF THE OVUM COMPARED. (After Hertwig, Weismann, and Delage.)

A, *Spermatogenesis* :—a_1, the primitive sperm-cell; a_2, the mother sperm-cell; a_3, two sperm-cells; a_4, four sperm-cells.

B, *Maturation of Ovum* :—b_1, the primitive ovum; b_2, the mother egg-cell; b_3, ovum and first polar body (pb_1); b_4, ovum with second polar body (pb_2), and division of first polar body into two.

sperm-cell with, let us say, four chromosomes again. As this cell grows, it doubles its number of chromosomes to eight. Then this mother sperm-cell goes through a double reducing division, first splitting up into two daughter-cells

with four chromosomes each, and finally into four granddaughter sperm-cells with two chromosomes each. These are all of equal size, and all function as sperm-cells. They are the primitive spermatozoa, which soon assume the proper shape characteristic for each species (see Fig. 27).

The parallelism between maturation and spermatogenesis will be quite clear from the adjoined scheme (Fig. 28).

We must add that in both cases the chromosomes finally lose their identity, forming a network of chromatin, as shown in the ordinary body-cells.

2. *COPULATION.*

In order that the germ-cells, male and female, may reach each other, the most varied contrivances exist in Nature. Darwin has described most wonderful adaptations in flowers for the purpose of attaining fertilisation either by the agency of the wind or by insects.

In the animal kingdom, the means of bringing together male and female germ-cells, the spermatozoon and the ovum respectively, are in the lower classes of extreme simplicity. The liberated sex-cells meet each other in a random manner, brought together by water currents, etc., either within the body-cavity (as in sponges) or outside it (as in the sea-squirts). There is, it is true, a subtle chemical attraction between the generative elements, but only when they are in close proximity, so that external union is largely left to chance. It is only when we ascend higher in the scale of organisation that special precautions are taken to insure the safe union of both sex-elements. Thus the male cuttle-fish (*Argonauta*) discharges one of his modified arms filled with spermatophores (packets of spermatozoa) bodily into the cavity of the female, where it bursts.

The female fish lay eggs closely followed by the attracted males, who thereupon fertilise the eggs with their sperm. A further step in this direction is made by the frog. Here fertilisation still takes place outside the body of the mother-animal, but the male, embracing the female, liberates the spermatozoa directly on the eggs as they are laid. Final security is reached by the act of copulation proper, where nothing is left to chance. Special organs exist in the female to receive the sperm, in the male to introduce it into the female sex organs, where

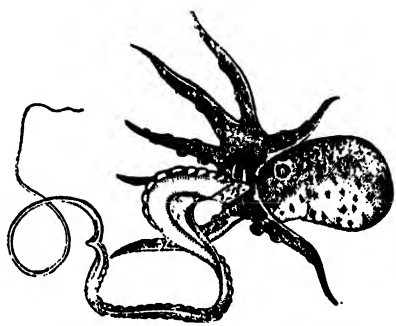

FIG. 29.—MALE OF CUTTLEFISH (ARGONAUTA) WITH MODIFIED ARM.

(*From Geddes and Thomson, "The Evolution of Sex."*)

the ovum is ready to unite with it in order to accomplish the process of fertilisation.

To the description of these organs in the human female and male we now turn.

3. *SEX ORGANS IN MAN.*

The sex of man, as of all animals, is decided by the sex glands—*i.e.*, those organs of the body which produce either the female ova or the male spermatozoa. It does not depend upon the external sex organs, which,

as we shall see later, may in certain cases fail to correspond with the sex of the sex glands. Now, the human embryo possesses in its earliest stages both kinds of sex glands, male and female, and the corresponding ducts. One set of sex glands and ducts gradually dwindles away, so that towards the end of the sixth week the embryo shows its ultimate distinctive sex, either male or female. Traces of the ducts of the opposite sex, however, normally persist even in the adult, while their

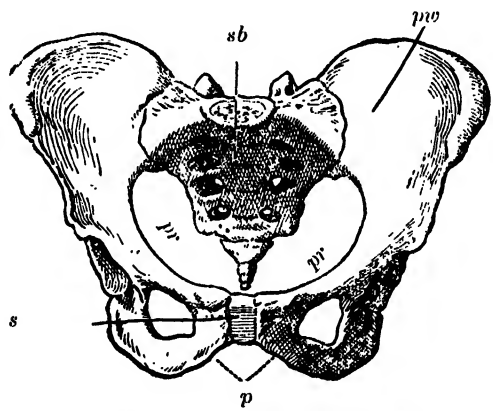

FIG. 30.—THE PELVIS (FEMALE).
(*From Johnstone's "Midwifery."*)
pw, pelvic wing; *sb*, sacral bone; *s*, symphysis; *p*, pubic arch; *pr*, pelvic rim.

development in a more marked form leads to patho logical hermaphroditism.

The sex organs occupy the floor of the pelvis, which is the bony structure supporting the trunk of the body and its contents. The pelvis is a bony ring, and consists of the sacral bone, forming the back, and the two pelvic wings, which are joined together in front in the symphysis. The lower inner edge of the two pelvic wings, together with the symphysis and the protruding edge of

the sacral bone, forms the pelvic rim. The symphysis can be felt beneath the skin as a slight prominence at the lower end of the abdomen. It is covered with the pubic hair. In women it is padded with a small cushion of fat, and is called the "mons veneris" (the mount of Venus). The two descending branches of the pelvic bones below the symphysis form the pubic arch, and support the external sexual organs. The bottom of the pelvic cavity is closed up by muscle and skin, which have gaps for the passing of the excretory and sexual organs. We find at the back, near the sacrum, the opening of the gut (anus); in front, just behind the symphysis, the bladder; and between them the sexual organs (see Figs. 32 and 36).

(*a*) The Female Sex Organs.

The external female sex organs, or vulva, consist of two large vertical folds of skin, the large labia (lips), inside which are two smaller lips, running parallel, called the nymphæ (nymphs). The outside of the large lips is covered with hair; the remainder of the external sex organs is moist, and more like the mucous membrane* of the mouth. On separating the nymphæ there can be seen the entrance to the sex canal proper, called the vagina (sheath), and just above it the external opening of the urethra, the duct which carries off the urine from the bladder (see Fig. 31). The vaginal entrance, when intact in the virgin, is partly closed up by the hymen. This has generally the shape of a semilunar fold occupying the lower half of the vagina; but it may be of various forms—annular, fimbriated (fringed), or altogether abnormal. At the upper end of the median

* Mucous membrane is the inner lining of any of the internal organs, as mouth, stomach, etc., which furnishes the liquid secretion particular to each organ.

groove lies the clitoris, covered by a fold of the small labia, which is called the prepuce (foreskin) of the clitoris. The clitoris is the equivalent of the male penis, but is not perforated by the urethra like the latter. The clitoris consists, like its male equivalent, of erectile tissue, and is very sensitive. Erectile tissue is essentially a conglomeration of wide bloodvessels which can be fully distended with blood and thus rendered turgid. From the clitoris the erectile tissue extends in two oblong masses around the entrance of the vagina, hidden beneath the skin of the nymphæ. The fleshy part between the posterior end of the vulva and the anus is called the perineum.

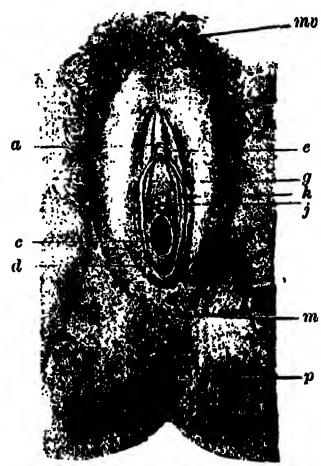

FIG. 31.—EXTERNAL FEMALE SEX ORGANS.
(*From Johnstone's "Midwifery."*)
g, large labium; *h*, small labium; *a*, prepuce of clitoris; *e*, free end of clitoris; *j*, orifice of urethra; *c*, vagina; *d*, hymen; *p*, anus; *m*, perineum; *mv*, mons veneris.

If we now follow up the sexual tract (see Fig. 32, which represents a cut lengthwise through the middle of the body), we find that the urethra leads behind the symphysis into the bladder, from which it carries the urine outwards. Behind the urethra lies the vagina. It is an elastic tube lined with mucous membrane curving upwards and backwards until it meets the womb or uterus. It is about 2½ to 3 inches long, and forms, when not extended, a broad flat horizontal slit. Its inner wall is not smooth, but has little ridges.

The uterus or womb lies immediately behind the bladder, and leans forward on to it, so that its axis forms an angle

with the vagina. In its fully developed virgin state it is about 3 inches long, is pear-shaped, and flattened from back to front. Its main body tapers off towards the vagina. The lower slenderer part is called the cervix or neck of the uterus; it is divided from the main body by a constriction, and its lower end projects somewhat into

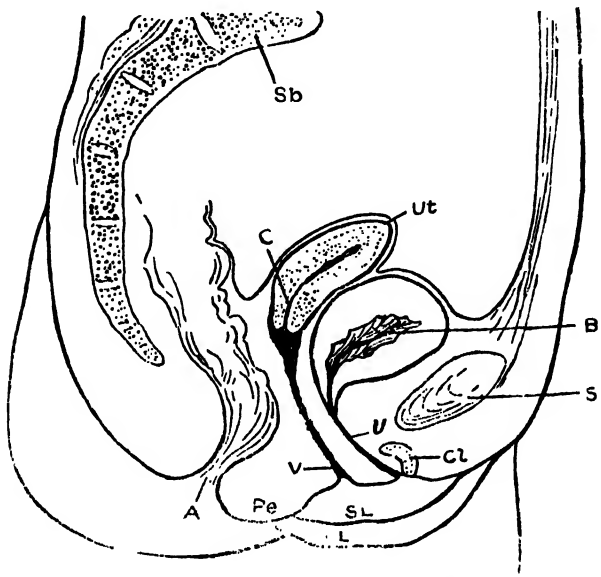

FIG. 32.—MEDIAN SECTION THROUGH FEMALE PELVIS.
(*After Heitzmann.*)

S, symphysis; *Cl*, clitoris; *V*, vagina; *SL*, small labia; *LL*, large labia; *Pe*, perineum; *A*, anus; *U*, urethra; *B*, bladder; *C*, cervix; *Ut*, uterus; *Sb*, sacral bone.

the vagina. The opening of the womb into the vagina is called its external os or mouth; the constricted opening of the canal between the neck and the body of the uterus is the internal os. The thick wall of the uterus consists almost entirely of muscles; the relatively small

cavity is lined with mucous membrane. Sometimes the uterus may show an indention lengthwise, or the two upper corners are drawn out like two horns. Even a complete doubling of the uterus may occur in exceptional cases. This is a reversion to a lower biological stage; for many lower animals have a double uterus, joined in the middle.

If we now view the uterus from the front (or back), we see that two tubes lead out of it, one at each side (see Fig. 33). These are about 4 inches long, and end in open

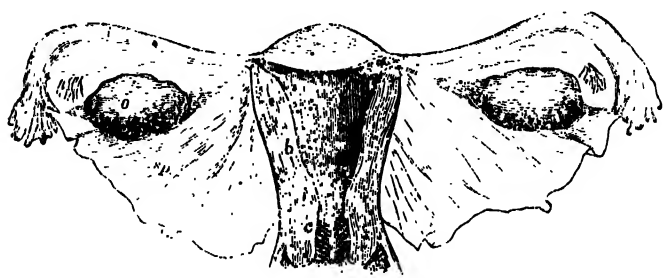

FIG. 33.—UTERUS AND APPENDICES VIEWED FROM BEHIND.
(*From Johnston's "Anatomy."*)
b, body of uterus; *c*, cervix; *t*, oviduct; *o*, ovary; *i*, fringed open end of oviduct; *v*, vagina; *sp*, supporting membrane.
(The uterus is shown cut open, giving a view of the cavity.)

funnel-like trumpets which are fimbriated, or fringed, all round. They are the oviducts or Fallopian tubes, which conduct the ripe ova from the ovary to the womb.

The ovaries, which are the essential female sex glands, are situated, one on each side of the uterus, below the oviduct, just inside its expanded end, and are kept in position by a supporting membrane. They consist of a stroma—*i.e.*, a supporting tissue, in which are embedded the ova. These are contained in the Graafian follicles. The Graafian follicle is a hollow vesicle lined with cells

and filled with liquid, at the bottom of which lies the human ovum. This consists of a transparent membrane, the yolk, and the nucleus of the cell, here called the

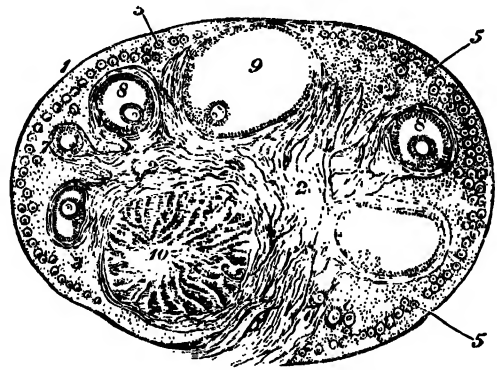

FIG. 34.—SECTION OF OVARY. (After Schrönn.)
(*From Gray's "Anatomy,"* 1905.)
1, outer covering; 2-4, supporting stroma; 5, Graafian follicles in their earliest stage; 6-8, more advanced follicles; 9, an almost mature follicle; 10, corpus luteum.

germinal vesicle. At the ripening of the ovum the Graafian follicle gradually approaches the surface of the ovary, then bursts and discharges the ripe ovum on to the outside of the ovary, whence it is swept by the fringed

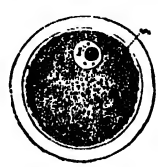

FIG. 35.—HUMAN OVUM.
(*From Galabin's "Midwifery,"* 1900.)
1, germinal vesicle; 2, yolk.

end of the oviduct into the tube, and thence into the uterus. This process is called ovulation. After the escape of the ovum the Graafian follicle undergoes a

retrograde change, and forms the corpus luteum (*i.e.*, yellow body, on account of its colour). A fresh corpus luteum is always a sign of a newly discharged ovum.

Menstruation.

Menstruation is the periodical flow of blood from the female genital organs. It is also called the menses (months), the monthly period, or, shortly, period. It is preceded by a heightened turgescence of the genital tract and an increased secretion of mucus from the vagina. The menstrual cycle recurs about every four weeks, but may vary within wide limits from two to six weeks, or may change in the same person without any sign of ill-health. The flow lasts, as a rule, from three to six days. It generally commences slowly the first day, reaches its height on the second or third day, and then gradually ceases. The amount of blood lost is on the average about 3 ounces. Menstruation first occurs at puberty, between the fourteenth and sixteenth year; but it appears earlier in hot and Eastern climates. The age also varies according to race. Rich living, mental stimulation and premature sexual experience tend to hasten the advent of the period; while feeble health and poor diet have the contrary effect.

The menstrual blood comes from the uterus. The mucous membrane of the uterus swells up and becomes congested with blood. The small bloodvessels break down under the pressure, and the blood escapes into the uterine cavity, and thence into the vagina. According to some authorities, blood also passes through the undamaged walls of the congested bloodvessels. The hæmorrhage involves a partial destruction of the uterine lining, which varies considerably in extent in different cases. In some cases the mucous membrane is cast off to such a

degree that it leads to a painful condition nearing disease. Such abnormal or otherwise pathological menstruation is called dysmenorrhœa. After the cessation of the sanguineous flow the mucous membrane of the womb repairs again, until the same cycle starts once more.

The bleeding is not the only periodical phenomenon connected with menstruation. Nearly all the organic functions of woman are more or less affected. Indeed, there exists a regular monthly physiological curve in woman, the functional capacity varying with the monthly change. The curve rises quickly just before the menstrual period: the pulse-rate quickens; the blood-tension increases; the breasts swell; there is a general heightening of vital activity and of the emotions. During the flow itself there is a sudden drop in the curve, when vital energy is at its lowest. There is diminished self-control, greater impressionability, and sometimes in nervous women depression and ill-temper. In extreme cases actual pathological conditions may supervene, such as melancholia or even periodical insanity. After the menstruation the curve rises again, making another slight elevation, and then assumes its normal level, until the same cycle is repeated again at the next period.

Menstruation marks the attainment of the age of puberty in the girl. The periods are at first not very regular, often being delayed and leading to premonitory pains. The first ovulation coincides with the first period, though pregnancy has been observed before the advent of the first menstrual period. Ovulation may take place just before, during, or just after, the period. The last is believed to be the most common occurrence. There is an increased sexual desire during this time, which is greatest just after the period, and often just before it. Contrary to the general lay opinion, it may even be markedly present during the flow itself. If conception—*i.e.*, union

of the ovum with the male sperm—ensues, menstruation ceases during the time of gestation, though in rare cases it has been known to persist during the early months of pregnancy.

Menstruation ceases altogether in woman at an age between forty and fifty, generally about forty-five. Degenerate changes set in in the ovaries and uterus, and there is general atrophy of the genital tract. This state is called the menopause or the climacterium, spoken of in ordinary language as the "change" in woman. It lasts from about three to five years, during which time menstruation is very irregular and gradually ceases. Sexual desire generally abates, though it may persist after the change. Frequently there arise general nervous disturbances of the body, hot flushes of the face, etc. In some extreme pathological cases actual climacteric insanity may occur.

(*b*) The Male Sex Organs.

We can distinguish in the human male as in the female the organs serving for copulation, and the essential sex glands. The male sex gland is called the testis or testicle, and it lies in the scrotum, a pouch of skin which is suspended from the pubic arch. The scrotum corresponds to the large labia: this is still indicated in the median line of junction which connects the right and left half of the scrotum. There is one testicle in each side of the scrotum; it is about the size of a small hen's egg. As the testicle is originally situated within the body cavity like the ovary, it has to pass through the abdominal wall in order to get into the scrotum. Indeed, a descent of the testicle actually takes place during fœtal development. Sometimes the testicle is arrested in this descent halfway down, and may remain hidden within

the abdomen (cryptorchism); or it may lie just outside the abdominal wall in the groin. The latter condition is very painful, as the testicle, which is very sensitive, is there exposed to constant friction.

The testicle consists of the main body (the testicle proper), which is composed of a large number of convoluted tubes supported by a stroma. These tubes are the essential secretory glands; they are entirely made of cells which elaborate the spermatozoa. The latter are discharged, together with a certain amount of fluid, as semen into the cavity of the tubes, and thence into the accessory body of the testicle, the epididymis. This is a conglomeration of tubes tightly packed, and ending in a single excretory duct, the vas deferens. This, together with nerves, arteries, etc., forms the spermatic cord, which leads into the abdominal cavity by the same path by which the testicle originally came down. As a matter of fact, the testicle in its descent carries the spermatic cord down with it. The vas deferens here finally enters the male urethra, as we shall describe later. It is thus that the spermatozoa are ultimately discharged into the copulatory male organ.

This male copulatory organ is the penis. It is about 2½ to 3 inches long in the adult, and is attached to the pubic arch. It consists mainly of erectile tissue—*i.e.*, a large mass of sponge-like tissue filled with venous blood. These blood-spaces can be distended with blood to the utmost, and thus render the whole organ stiff and erect. The apex of the penis forms a bulbous head, called the glans. The skin over the penis is attached very loosely, to allow for the increased size of the organ during its state of erection. It protrudes over the glans in the form of a fold, which is called the foreskin or prepuce of the penis. It is this prepuce which is removed in the operation of circumcision. The penis is traversed

along its whole length by the urethra, the passage which carries off the urine from the male bladder. The clitoris of the female corresponds to the penis, except that it is not pierced by the urethra.

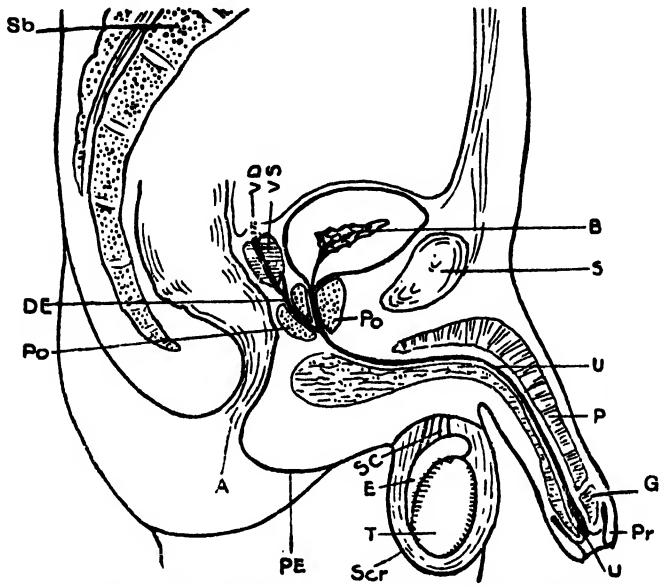

FIG. 36.—MEDIAN SECTION THROUGH MALE PELVIS.

U, Urethra; *Pr*, prepuce; *G*, glans; *P*, penis; *T*, testis; *Scr*, scrotum; *E*, epididymis; *SC*, spermatic cord; *PE*, perineum; *A*, anus; *S*, symphysis; *Po*, prostate; *DE*, ejaculatory duct; *B*, bladder; *VS*, seminal vesicle; *VD*, vas deferens; *Sb*, sacral bone.

(*Modified after Heitzmann.*)

(The testicle, epididymis, and spermatic cord, also the seminal vesicle, the vas deferens, and ejaculatory duct, do not lie in the median line of section, but they have been given in the illustration in order to indicate their relative position.)

Following the urethra upwards (see Fig. 36), we find that it bends round the symphysis, after it has left the penis, and enters the bladder. The section of the

urethra lying between the penis and the bladder is surrounded by the prostate, a glandular organ which contributes an additional viscid fluid to the semen, when ejected. Behind the bladder lie the two seminal vesicles. Their function is unknown, except that they add some fluid to the semen. Each of the seminal vesicles joins at the lower end the vas deferens of its respective side. Thus two common ducts are formed, the ejaculatory ducts, which pierce the prostatic gland and enter the prostatic part of the urethra. We see, then, that while in the female the urethra and the genital tract are entirely separate, in the male the reproductive tract enters the urinary passage; the same path serving for the emission of the semen and of the urine. Behind the penis and the scrotum we find the anus. The space between anus and scrotum is called the perineum, as in the female.

4. *COPULATION IN MAN.*

The biological meaning of the two sexes lies in their union for the purpose of procreation. It is therefore essential that the male and female sex-cells should meet together in the process of fertilisation in order to form the new being. Now, as a rule, the ovum stores nutriment, and is therefore relatively large and immobile; while the male sperm is small, very active, and mobile. This has been expressed by Professors Geddes and Thomson in the words that, as regards metabolism, the ovum is anabolic, building up and conserving energy; while the male sperm is katabolic, breaking down nutriment and spending energy. It is therefore the male germ which seeks the female.

The ovum, as we have seen, reaches the uterus through the oviduct. The spermatozoon now has to find access to the ovum and reach it through the vagina. This is

attained by the process of insemination; that is, the semen of the male is discharged by means of the male copulatory organ into the female receptacle. For this purpose the male organ is introduced into the vagina in the act of copulation or coitus.

Before coition is feasible the copulating organs have to be brought into the appropriate state for its consummation; the male organ has to become erected in order to be able to penetrate into the vaginal canal, while the female external organs add their share in facilitating the act of intromission. The whole stage of preparation up to the culmination of the sexual act of union, the actual discharge of the semen, has been called by Havelock Ellis the stage of tumescence, in contradistinction to the stage of detumescence which follows after the climax has been attained. "In tumescence the organism is slowly wound up and force accumulated; in the act of detumescence the accumulated force is let go, and by its liberation the sperm-bearing instrument is driven home." This state of tumescence is attained by stimulation of the nerve endings of the sex organs. The stimulation is partly mental, due to the emotion raised by courtship and love-play; partly physical, produced by direct friction of the copulatory organs. Every act of coitus, in order to be realised with full pleasure, must therefore be preceded by an abbreviated act of courtship which brings about the necessary state of tumescence.

We have already noticed, in the description of the external sex organs of both sexes, that they are furnished with erectile tissue. The vulva during the act of copulation becomes congested and swollen; the labia are rendered turgid. The same takes place in a still greater degree in the clitoris, which is the specific female organ of voluptuous sensation and becomes semi-erect by friction. At the same time all parts of the vulva are bathed

copiously with mucous fluid from the various glands of the genital tract. On the side of the male, the stage of tumescence shows itself in a stronger, more active way. The penis, which is practically made up of erectile tissue, becomes extended and erect. The intromission of the highly sensitive glans penis into the vagina stimulates this process still more, the mutual friction of the clitoris and glans leading to a reciprocal enhancement of the voluptuous sensation in both partners. The motor discharge now following is not confined to man only. While the penis makes violent ejaculatory movements, the vagina contracts spasmodically. The climax of the orgasm is reached by the ejaculation of the semen into the vagina. According to the latest researches, it is very probable that here too, far from being passive, as is the general opinion, the woman takes an active part. There is a rhythmic contraction of the whole genital tract, the uterus descending into the vagina, its mouth opening intermittently and thus, as it were, sucking up the semen into its cavity. With the act of ejaculation the stage of detumescence is reached. The tension which had pervaded the whole organism is now relaxed. A feeling of deep satisfaction and repose ensues. While with man this may tend towards languor, with woman it is often enhanced to a profound feeling of beatitude.

In the first act of coition the hymen of a virgin is usually ruptured, and defloration is said to have taken place. It must, however, be noted that the hymen, if of an elastic and yielding nature, may remain intact in exceptional cases.

Though, as a rule, conception only occurs after a proper act of coitus, cases of impregnation without actual penetration have undoubtedly been observed. The spermatozoa, possessing great mobility of their own, may reach the uterus by their active upward movements, even when deposited outside the vulva.

CHAPTER III

PHYSIOLOGY OF REPRODUCTION

It is a strange fact that, although the union of both sexes was thought to be the essential factor in the act of reproduction, it was a considerable time before the true import of both male and female germs was recognised. Two schools—the Ovists and the Animalculists—held sway for a long time in fierce opposition to each other, the former declaring the ovum as the all-important element in fertilisation, while the latter attributed this rôle, with the same one-sidedness, to the spermatozoon (animalcule). And even after due credit had been given to both elements alike, the real meaning of their union was far from being understood, it being held that a sort of seminal breath (aura seminalis) passed from the seminal fluid to the ovum. It was only about 1875, with the recognition of the cell-structure of the sex-elements, that the correct interpretation of fertilisation was found in the union of the nuclear substance of the male and female sex-cell.

1. *FERTILISATION.*

The spermatozoa as the active element swarm round the ovum. Usually, however, only a single spermatozoon finds entrance, as the ovum, in some yet unexplained manner, closes against the intrusion of all the others (see Fig. 37). The ovum has already gone through its ripen-

ing process, and possesses, to take the example of the round-worm of the horse (*Ascaris megalocephala*), two chromosomes. The nuclear substance of the sperm-cell then changes its appearance. It becomes pale, grows in size, and its network of chromatin transforms itself into two chromosome loops, the same also taking place with the chromatin of the ovum. Simultaneously the centrosome introduced with the spermatozoon has doubled (the centrosome of the ovum generally plays no rôle, and disappears), and forms a double aster; while the two pro-

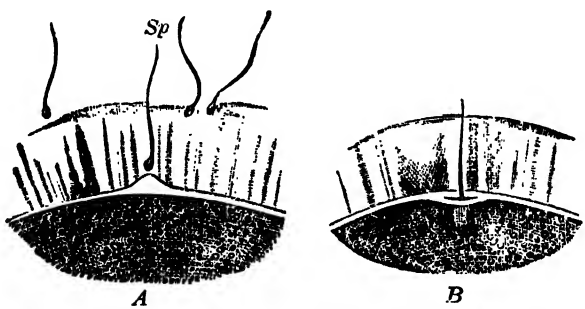

FIG. 37.—FERTILISATION OF OVUM.

(*From "Textbook of Zoology," by Carl Claus.*)

A, part of the ovum with spermatozoa (*Sp*) on surface; *B*, one spermatozoon entering the ovum.

nuclei, as the male and female nuclei are now called, approach each other in order to coalesce and form a single segmentation nucleus. This segmentation nucleus, being formed by the union of male and female nucleus, now contains the hereditary substance of both germ-cells, maternal as well as paternal, and once more possesses four chromosomes—two from the father and two from the mother. What has been formed is, indeed, the mother-cell, from which the new individual arises in the ordinary manner of cell-division; that is, the chromosomes split

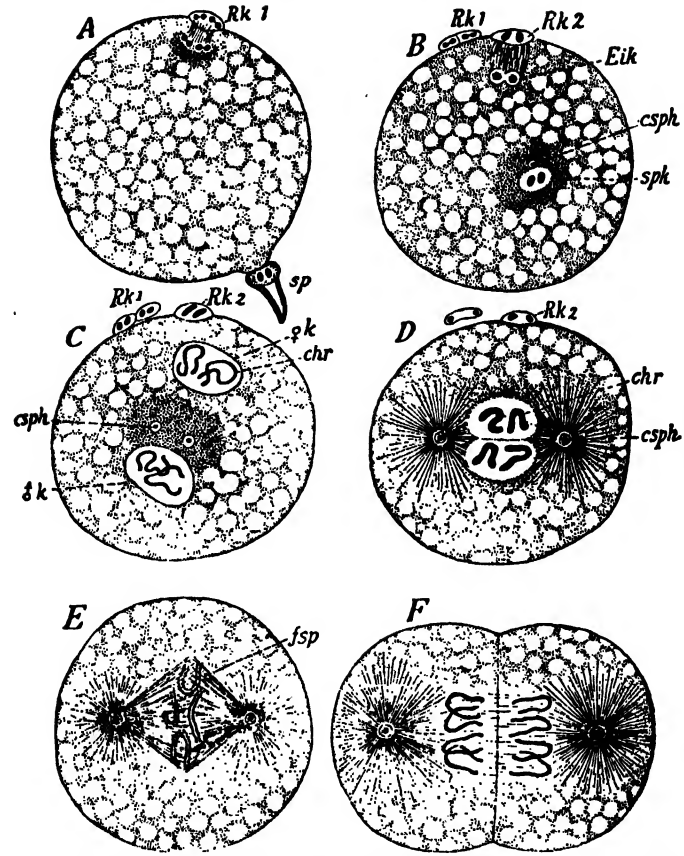

FIG. 38.—FERTILISATION IN ASCARIS MEGALOCEPHALA. (Adapted from Boveri and Van Beneden.)

(*From Weismann*, "*The Evolution Theory.*")

A, spermatozoon (*sp*) about to penetrate ovum, which has one polar body (*Rk*1); *B*, spermatozoon (*spk*) with its centrosome (*csph*) has entered ovum, which shows ovum-nucleus (*Eik*) and three polar bodies (*Rk*1 and *Rk*2); *C*, sperm-nucleus (♂*k*) and ovum-nucleus (♀*k*) show each two chromosomes (*chr*); *D*, coalescence of sperm-nucleus and ovum-nucleus into segmentation-nucleus; *E*, division of segmentation-nucleus; *F*, formation of the first two embryonic daughter-cells by karyokinesis

lengthwise, wander to the opposite poles, and, surrounding themselves with the separated halves of the cell-body, form two new daughter-cells, each possessing, again, four chromosomes—namely, two from the father and two from the mother. The daughter-cells repeat this process of division, and by continued subdivision of the same kind the organism is finally built up. Thus is brought about the mingling of the parental qualities in the mother-cell, and their equal distribution throughout the line of the descendant body-cells.

It may seem from the description of these facts as if, in the act of fertilisation, the combination of both elements, male and female, were essential, both being, as it were, complementary to each other. But this is by no means the case. Male and female nuclei are not two different halves producing together the new offspring, but both are of equal value, each representing by itself a complete individual. This will at once become apparent from the fact that for the purpose of embryogenesis (development of the embryo) either of the germ-nuclei may in certain circumstances be dispensed with.

Thus Professor Delage has shown that non-nucleated fragments of eggs of the sea-urchin (*Echinus*) can be successfully fertilised by the sperm and develop into an embryo, showing thereby that the presence of the ovum-nucleus is not a condition *sine qua non* of embryonic development. On the other hand, that the sperm-nucleus can be dispensed with appears from some experiments of Professor Loeb. He induced ova of the sea-urchin *Arbacia* to develop parthenogenetically—*i.e.*, without the introduction of a spermatozoon—by bringing them for a short time into a mixture of 50 per cent. sea-water and 50 per cent. magnesium chloride.

The cases of partial and total Parthenogenesis already mentioned also point to the same conclusion—that the

egg-cell alone is capable of starting its own embryogenesis.

We have thus in fertilisation a twofold process: firstly, a stimulus given to the germ-cell towards embryogenesis, this stimulus being supplied either by the germ-cell of the opposite sex or by some other means; and, secondly, amphimixis—*i.e.*, the co-mingling of the hereditary substances of the two parent-nuclei.

2. *EMBRYOGENY.*

In accordance with their theories of fertilisation, the Ovists and Animalculists held that the future embryo was contained in the ovum or spermatozoon respectively. They conceived the embryo lying literally ready made in the germ-cell they respectively favoured, though in a very minute form. All that was supposed to take place was an unfolding of the preformed embryo (*evolutio*), as a bud unfolds itself into a flower. This theory is known, therefore, by the name of Preformation or Evolution theory,* also Scatulation theory, because the miniatures of the successive generations were imagined to lie, like nests of boxes, one within the other, in ever-increasing minuteness.

It is evident from what has been learnt already that this crude theory is altogether baseless and unsubstantiated by facts. The truth had, indeed, been vaguely guessed at here and there (Aristotle, Harvey), but was only finally established by the splendid observations of Caspar Friedrich Wolff, who in his "Theoria Generationis" (Theory of Generation), 1759, demonstrated conclusively that the chick gradually assumed its complex organisation from a

* This evolution is not to be confused with Evolution in the modern and wider sense of progressive development in nature, as expounded by Darwin and others.

comparatively simple and homogeneous matrix by a process of new-formation or Epigenesis. The organs were not preformed, ". but could actually be seen being formed." Later Von Baer first formulated the funda-

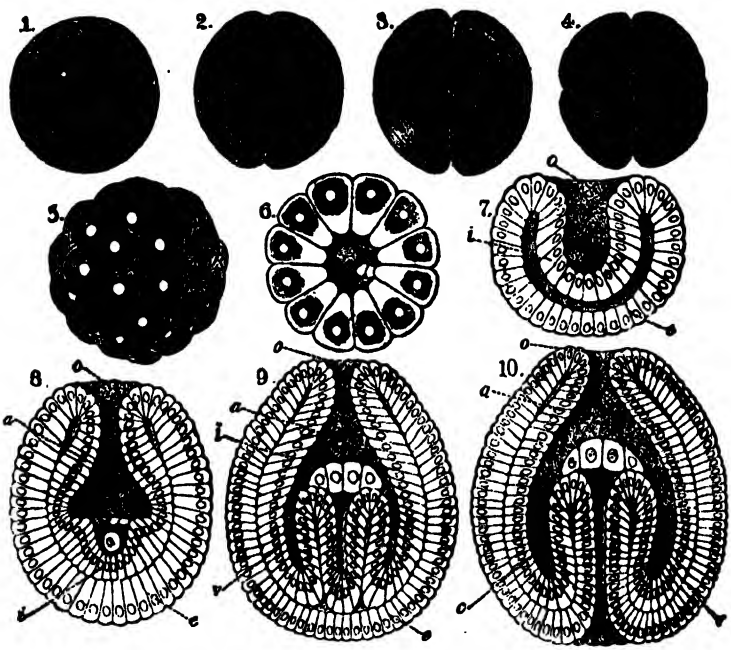

FIG. 39.—EMBRYOGENY OF SAGITTA.

(*From "Natural History of Creation," by E. Haeckel. By kind permission of the Author and Publisher.*)

1 to 4, primitive mother-cell with successive divisions; 5, morula; 6, blastula; 7 and 8, gastrula; 9 and 10, cœlomula; *e*, ectoderm; *i*, entoderm; *o*, primitive mouth; *a*, primitive mouth or gut cavity; *v*, cœlom folds; *c*, cœlom cavity.

mental laws of this development by showing how the embryonic cells arranged themselves first into the germinal layers, then into the different tissues, organs, etc.

Just to indicate in outline the first stages of embryo-

genesis, we must remember that we distinguished, according to the arrangement of the yolk, four kinds of ova. We had the ovum with (1) diffuse, (2) central, (3) polar, and (4) predominant yolk. All the different ova develop on the same principle, which is only modified according to the disposition of the yolk. The primitive mother-cell, after the division of its nucleus by karyokinesis, splits into two daughter-cells; these in the same manner into four granddaughter cells; and so forth, until a solid ball of cells is formed, in appearance very much like a mulberry, and therefore called a morula. This morula undergoes further changes. Its central cells liquefy, so that instead of a solid ball we now get a hollow sphere, composed of a single layer of cells, and called a blastula. From this blastula arises the next stage, the gastrula, which consists of an outer layer of cells (the ectoderm), and an inner layer of cells (the entoderm), both enclosing the primitive mouth cavity (Fig 39). It is as if the blastula had been doubled in upon itself like a hollow india-rubber ball. Finally, the third layer, the mesoderm, is formed between ectoderm and entoderm, and the formation of tissues goes on apace until the final form of the completed embryo is reached. All these stages are, with regard to their general plan, identical in all multicellular animals; they differ in the various classes of animals only in the precise arrangement of the cells, which depends on the amount and distribution of the nutritive substance originally contained within the ovum.

We can distinguish, according to the four kinds of ova, four kinds of segmentation, with four kinds of gastrulæ (see Fig. 40), namely:

1. The egg with diffuse yolk shows equal segmentation (all the cells dividing evenly) and a bell-shaped gastrula. Types: Sponge, Amphioxus.

2. The egg with central yolk, the outer portion only

dividing, has superficial segmentation and a spherical gastrula. Types: Crusters, Insects.

3. The egg with polar yolk has unequal segmentation, the cells at the upper pole, free from yolk, dividing faster

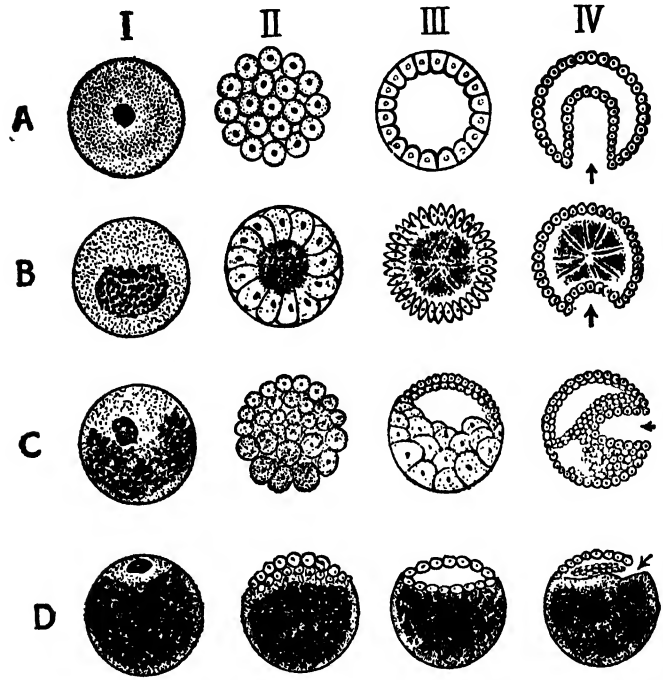

FIG. 40.—EMBRYOGENESIS OF (*A*) SPONGE, (*B*) CRAYFISH, (*C*) FROG, (*D*) BIRD. (After Thomson and Haeckel.)

I, ovum; II, morula; III, blastula; IV, gastrula.

and leading to a hooded gastrula. Types: Amphibians.

4. The ovum with predominant yolk, where again only the germinal vesicle divides on top of the yolk, thus leading to the discoid gastrula. Types: Reptiles, Birds, Monotremata.

There is only one more point to which we wish to draw attention in this connection. As the mammals have descended genetically from the reptiles and birds, yet have lost the yolk of their eggs (the mammalian embryo is nourished within the uterus of the mother, and does not need the yolk), the development of the mammalian ovum has reverted from the bird-type, which is still prevalent among the Monotremata, the lowest mammals, to a more primitive type, though the exact details are not yet completely cleared up. On the other hand, the lowest vertebral animal, the Lancelet or *Amphioxus*, has a segmentation of the most primitive type, like the sponge, showing thus the close connection between the two species so far distant in the scale of organisation.

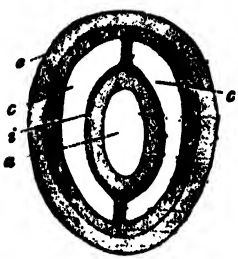

FIG. 41.—TRANSVERSE SECTION OF A YOUNG SAGITTA. (After Hertwig.)

(*From "The Evolution of Man," by E. Haeckel.*)

e, Ectoderm or outer covering of body; *i*, entoderm or inner lining of gut; *a*, gut-cavity; *c*, cœlom or body cavities.

In the further transformation of the gastrula a division of the primitive mouth cavity takes place by the growth of two folds (cœlom folds), which start from the dorsal side of the embryo, and gradually elongate, to meet at the ventral side (see Fig. 39). By the formation of these two folds the original mouth cavity is divided into three parts: the middle part becomes the gut cavity of the animal, while the two side-cavities represent the two body or cœlom cavities of the fully developed organism. We have herewith reached the archetype of all higher animals, which thus consists essentially of two long tubes, the outer tube forming the body covering, and the inner tube forming the gut cavity. Between the gut and the outer

covering lie the two cœlom or body cavities, separated from each other right along the back and front (Fig. 41). The later and final stages of the development of the embryo are essentially similar in process, and consist in further complications of this fundamental scheme by additional foldings, etc.

We give in Fig. 42 three of these stages of the human embryo during the first three months of its development.

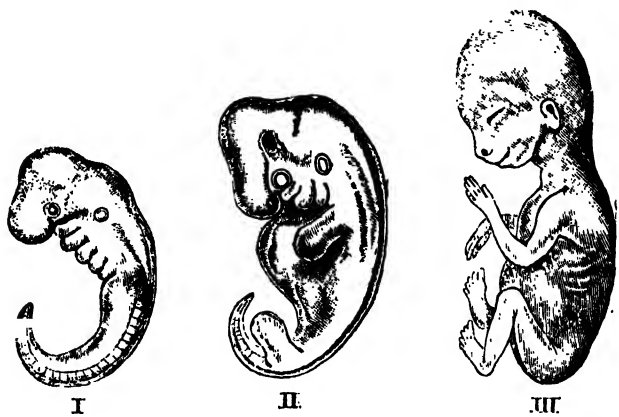

FIG. 42.—THREE SUCCESSIVE STAGES OF THE HUMAN EMBRYO. (*From "Darwin and after Darwin," by G. J. Romanes.*)

We see from these figures that the human shape is only gradually assumed by the embryo. When this has been attained it is called a fœtus.

3. *PREGNANCY.*

As soon as conception has taken place, pregnancy ensues. There now occur in the female organism certain changes especially adapted for the bearing and carrying out of the young. The uterus undergoes an enlargement and structural modification in order to be able to give

proper shelter and sustenance to the embryo growing inside it; while the mammary glands (the milk glands of the breast) develop considerably to yield milk to the new-born young.

In woman the first sign of pregnancy is the cessation of the menses. Morning sickness is a frequent symptom and commonly begins at about the second month, generally to disappear again at the end of the fourth month. The breasts swell up, and often yield drops of milky fluid even during the early months of pregnancy. The nipples develop more fully; the area around them becomes dappled with slight glandular elevations, the whole assuming, especially in brunettes, a dark brown colour. As the uterus enlarges in size, the abdomen becomes extended by it. But it is only after the third month that the uterus rises sufficiently out of the pelvis to reach the abdominal cavity. It is then for the first time that it can be felt externally on examination. It reaches the umbilicus at the end of the fifth month, is halfway between navel and lower end of breast-bone at the seventh month, and comes right up to the ribs, to the pit of the stomach, in the ninth month. The growing womb pushes the intestines and other abdominal organs aside. This often leads to constipation, and, in the later months of pregnancy, to frequent micturition, on account of the pressure of the uterus on the bladder. The enormous distension of the abdominal wall leads to stretching of the skin, so that it cracks in its lower layers. These cracks are visible as distinct lines (striæ) in the skin, and remain more or less permanent after repeated pregnancies. They are mostly to be observed at the sides of the abdomen, running parallel to the groin.

The duration of pregnancy up to the full term of birth is in the human female on the average 280 days—*i.e.*, ten lunar months. When the date of conception is

known, the probable date of confinement is computed by allowing nine full calendar months and one week as the duration of pregnancy. If only the date of the last menstruation is known, we must reckon from the end of that period. As conception may have taken place any time between the end of the last menstruation and the expected date of the next one missed—a period of about three weeks—we must allow for this margin of uncertainty.

At about the middle of pregnancy—*i.e.*, after four and a half months—the fœtal movements are for the first time felt by the mother herself. This is called the "quickening."

Of other phenomena consequent on pregnancy, we must mention a certain amount of disturbance of the circulation which gives pregnant women in their later months a heavy, bluish look of the face. Varicose veins of the legs, and piles—both due to stagnation of the blood in the veins—are a common concomitant of pregnancy. Pregnant women tend to be irritable and peevish, and prone to strange fancies. Their craving for unusual kinds of food is well known.

After discussing the external signs of pregnancy, we come to the description of the important inner changes occurring in the uterus. From the commencement of pregnancy a softening of the cervix takes place, and especially just above the external os. This is one of the earliest objective medical signs of pregnancy.

We have seen that the ovum reaches the uterus by way of the oviduct. When fertilised, it generally attaches itself to the uterine wall near the oviduct or at the upper part of the uterine body. From this moment the mucous lining of the uterus undergoes a great development. It swells up in its whole extent and becomes thicker, forming what is now called the decidua.

At the points where the ovum is attached to the uterus, the decidua gradually grows around the ovum, and ultimately envelops it completely. This part of the decidua is called the decidua reflexa or reflexed decidua, the decidua at the original site of attachment (placental site) being the decidua vera (real decidua), (see Figs. 43 and 44). While the corpus luteum degenerates rapidly after menstruation, it grows considerably during the first months of pregnancy, and does not entirely disappear for some time after it. According to the latest scientific opinion, the corpus luteum has the function of governing

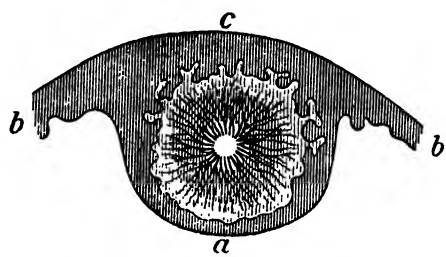

FIG. 43.—OVUM ATTACHED TO INNER SURFACE OF UTERUS.
(After Galabin.)
a, decidua reflexa; *c*, decidua vera; *b*, decidua of remainder of uterus.

the fixation of the ovum and helping to maintain its nutrition during the first stages of pregnancy. This is supposed to be due to some chemical substances being thrown into the general circulation of the body, a process which is called internal secretion.

The ovum and the uterus grow apace. We have already traced the development of the human embryo in the previous section on embryogeny. The embryo, however, does not lie bare in the uterine cavity. Two enveloping membranes grow out from the embryo in its very earliest stage of development, an inner and an outer one. The inner one is called the amnion, and soon

becomes filled with fluid. This fluid gradually increases, and serves the purpose of allowing free movements to the fœtus, and protecting it at the same time against external injury. The outer enveloping membrane is called the chorion, and is covered with soft villi

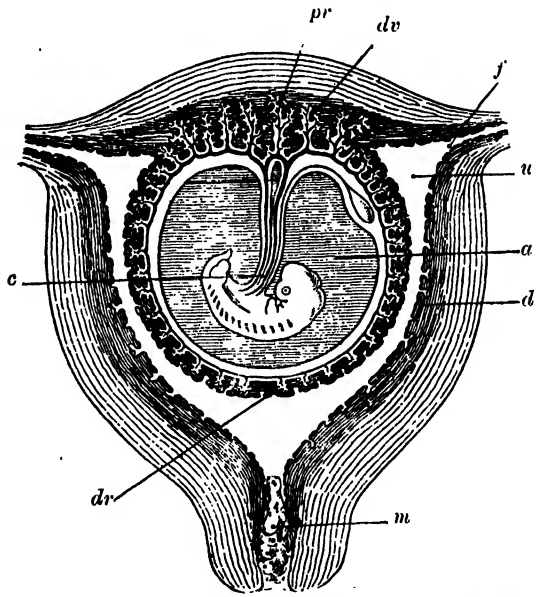

FIG. 44.—GRAVID UTERUS WITH EMBRYO AND MEMBRANES. (*From Gray's "Anatomy,"* 1905.)

u, uterine cavity; *dv*, decidua vera; *pv*, placental villi of chorion; *dr*, decidua reflexa, with non-placental villi; *d*, decidua; *c*, umbilical cord; *a*, amnion water; *f*, Fallopian tube; *m*, mucus in cervical canal.

(little tufts of tissue), which later on are traversed by small bloodvessels. These grow into the decidua all round, but especially at that part of the uterus where the ovum is attached (see Fig. 44). The decidua here grows considerably in thickness, and forms, together with the chorionic part of the ovum, the placenta. The

latter consists, therefore, of a maternal part, furnished by the decidua of the uterus, and a fœtal part, represented by the chorion. It is here that the fœtus is in connection with the maternal organism. This is effected by the umbilical cord, which runs from the umbilicus of the fœtus to the placenta. Bloodvessels lead from the fœtus through the cord to the placenta. Here the fœtal blood comes in contact with the maternal blood, which enables an exchange of nutriment and gases to take place between mother and child. As the fœtus grows and the amnion water increases, the uterine cavity is filled more and more, until the fœtal membranes touch the walls of the uterus. By this time the decidua reflexa has been worn away by the pressure of the contents, as also that part of the uterine decidua which does not form the placenta. The chorionic villi having long since completely disappeared at the free part of the ovum, we finally have two smooth membranes closely joined together. These are filled with fluid. As the umbilical cord has meanwhile grown to a considerable length—its average length is about eighteen inches—the fœtus is able to move freely inside the womb.

There may be more than one embryo growing at the same time in the womb, in which case we speak of multiple pregnancy. While twins are not infrequent (about one in eighty cases), triplets are much rarer (perhaps one in 6,000 cases). A greater number than triplets is extremely rare, but as many as five children at a birth have been observed. Twins may be of two kinds. Each of the embryos may have originated from a separate ovum; in this case each will have its own placenta and own set of membranes, though the placentas may be joined at their border. This is the most frequent occurrence. Or the two embryos may have arisen by a doubling or splitting of only one original ovum; in this case

there is but one placenta and one common bag of membranes. If the separation of the ovum is incomplete, we get joined twins, as in the case of the famous Siamese twins. The two ova belonging to the same menstrual period may have been fertilised during the same act of coitus, or their impregnation may have taken place by two successive acts. In the latter case, which is called superfecundation, the offspring may belong to two different fathers; thus, twins of different colour have been found at one birth, one white, the other mulatto. It is also thought possible that ova of different menstrual periods may be successively fertilised after some lapse of time. As ovulation is supposed to cease with the occurrence of the first conception, this can happen only in exceptional cases. If ovulation should persist for the first few months of pregnancy, an ovum may find sufficient hold for development, so long as the uterine cavity is not yet completely obliterated—that is, up to the fourth month. Or there may be a double uterus, in which case fertilisation may take place first in one horn of the uterus, and after some time in the other horn. This is called superfœtation. In this instance there will be a difference of a few months between the two children born.

We have seen that the ovum normally reaches the uterus for fertilisation. It may, however, in abnormal cases be arrested in its path, and become fertilised while still in the oviduct, or even in the abdominal cavity, if it should by chance have dropped there. This is called extra-uterine or ectopic pregnancy. These cases rarely go to full term, as there is not sufficient support for the growing embryo in the thin envelope holding it. In consequence, the embryonic sac bursts prematurely, with the result that dangerous hæmorrhage ensues, which may cost the mother her life, if not promptly dealt with by the surgeon.

4. *PARTURITION.*

When the fœtus has reached maturity, it is expelled from the uterus by means of muscular contractions. This is accompanied by a considerable amount of pain. The whole process of giving birth to the child is called "labour," and the contractions "labour pains." Premonitory pains occur with increasing frequency in the later months of pregnancy, without leading to labour. Sometimes these are so severe, especially in the last week or two of pregnancy, that delivery seems imminent; as they, however, pass off again, they are called spurious pains. It is only when the uterus actually begins to open out that real labour begins. This is generally indicated by a discharge of blood from the genital passage, due to the tearing of some small bloodvessels, as the bag of membranes begins to separate from the uterus near the internal mouth. This is called the "show."

We have already seen that the uterus is almost wholly composed of muscles. At parturition these contract powerfully around the fœtus with its bag of membranes, in order to expel it. The membranes filled with water are pushed into the cervix, which becomes gradually dilated, so that its cavity is finally taken up into that of the uterus. The next stage consists in the dilatation of the external mouth of the uterus. The membranes bulge more and more into it, and stretch it to the utmost, until the external os is fully dilated, and the uterus, cervix, and external os form one continuous open passage. It is now that the membranes rupture by the internal pressure brought to bear upon them (at least, this is the ideal condition, though in normal labour the membranes may break a little earlier or a little later without detriment to the proper progress of labour). Only part of the amniotic

fluid escapes, as the fœtal head comes down immediately upon the dilated os like a ball-valve and closes it. This ends the first stage of labour.

From now the fœtal head undertakes the further dilatation of the genital passage. It is pressed deeper and

FIG. 45.—NORMAL BIRTH.
(*From Galabin's "Midwifery,"* 1900.)
The figures 1 to 5 show the successive stages of head during birth.

deeper into the vagina, which during pregnancy has become very yielding and is copiously lubricated with mucous secretion. The pains become much more frequent now. As the head descends upon the perineum, the latter is bulged out forcibly. It gives more and more

by stretching, until the fœtal head is able to penetrate it and appears outside the vulva. This is by far the most painful stage of labour, but lasts in normal cases only a very short time. In the normal position of the head, its back or occiput is turned towards the mother's symphysis, the face showing towards the perineum. During the expulsion of the head the nape of the neck engages against the symphysis, while the brow, face, and chin, appear one after the other by sliding along the inner surface of the extended perineum (see Fig. 45). Once the head is born, the remainder of the body follows much more easily. For the head is the largest, and at the same time the hardest part of the body, while the shoulders, though broad, yield more easily. As the child is attached to the uterus by its umbilical cord, this has now to be severed. This is done about an inch or two from the navel of the child. As soon as the child comes in contact with the open air, it starts breathing and utters its first cry. It can now safely dispense with the use of the umbilical cord, through which it has breathed up to now. The surface of the child's body is generally covered with a smeary mass, a moist detritus of dead cells shed from the skin during intra-uterine life. The lanugo hair which shows on the whole body at birth falls out later.

There follows a short pause in the labour pains, before the third and final stage of parturition begins with the expulsion of the "after-birth." This consists of the placenta with the membranes and the remainder of the umbilical cord attached to it. A few uterine contractions are generally sufficient for this purpose. As the placenta breaks away from the uterus, there occurs a considerable amount of bleeding; but it gradually ceases as the uterus contracts vigorously and closes the torn bloodvessels.

The first stage of labour generally lasts in a primipara (a woman who has her first child) about twelve hours,

sometimes longer; the second stage about two to three hours; and the last stage, at most, half an hour. In women who have already had one child (multiparæ), the first two stages are much shorter, as the genital passages, having been opened out at the first confinement, yield so much more quickly.

The progress of labour depends chiefly on the relative size of the child's head and the mother's pelvis. While the soft parts of the genital tract are elastic and yielding, the pelvic ring, formed by bone, cannot give way. The fœtal head is somewhat compressible; for the bones of the fœtal skull are separated by soft membranes, and can thus by pressure be brought to overlap each other somewhat, thereby reducing the diameter of the fœtal head. But this is only possible within narrow limits. The head is moulded by the pressure brought to bear on it, and elongated, the occiput projecting considerably after birth. On the whole, in a normal case, the child's head has just room to pass through the bony pelvic ring. If the pelvis is too narrow, medical help is necessary to deliver the child. In severe cases the child may have to be sacrificed in order to save the mother. If the membranes are very thin and rupture prematurely, labour may be delayed considerably. For the fœtal head, being relatively large, cannot enter the cervical canal readily, so that the stage of dilatation is much prolonged.

In every confinement the edge of the cervix is torn, generally on one side. Such a scar of the external os is always an absolute sign of a woman having given birth to a child. In a virgin the external os is completely smooth. We have said above that the perineum yields slowly under the pressure of the advancing head. In many cases it does not stretch sufficiently to let the head pass, and its edge gets torn in consequence. The remnants of the hymen are usually torn, too, and heal up as little

wart-like projections of skin—the caruncles. In quite exceptional cases an intact hymen has remained so even after parturition. In difficult cases, when the perineum is very unyielding, especially in older primiparæ, the tear of the perineum may be considerable in extent, and has to be stitched by the medical attendant.

It is not our place here to deal with the abnormalities of labour. By far the greater number of cases run a regular course, or deviate only slightly from the normal. Generally the fœtal head engages in the pelvis, as it is the heaviest part of the child and sinks downwards. If there exists, however, some irregularity of the pelvis, it may be difficult for the head to enter the pelvis, and it may be prevented from coming down in the normal way. This leads to abnormal presentations. The head may be so turned that the face, instead of the occiput, looks towards the symphysis. In other cases the head may not come down at all, but the pelvic end of the child may present itself as the lowest part—pelvic or breech presentation; or the child may lie crosswise in the womb. All such cases need for delivery the prompt art of a skilled medical attendant. In twin pregnancies, the two children are born within a short interval of each other, generally about half an hour, though it may be longer.

We have still no light on the actual causation of labour. We do not know why it comes on at a certain time, nor why the majority of births occur at night time. Perhaps we may mention here that it has lately been found that, by the administration of a certain drug, a state of "twilight sleep" can be induced during parturition, which renders labour painless to the mother. At present opinion is still divided among the medical profession whether the method is safe for use in ordinary private praxis. It certainly has so far not found the adherence of the general practitioner.

Abortion.

Parturition may take place before full term. We then speak of abortion or miscarriage, if labour comes on before the child is viable—that is, up to the beginning of the seventh month; after this date we speak of "premature labour." The younger the child is at birth, the more difficult its rearing, so that a child of eight months' pregnancy is easier to rear than one of seven months, notwithstanding the general superstition that an eight-months child has less chance of living than a younger one. Abortion, or premature labour, is always due to some pathological cause, which is either local in the uterus or consists in a general disturbance of the mother's organism. It may also be brought on by external violence acting on the womb, or by a heavy strain, which leads to hæmorrhage, causing separation of the attached ovum. The taking of certain drugs is one of the most uncertain and risky means of producing abortion.

Abortion is a very common occurrence among child-bearing women. Contrary to the opinion of women-folk, it does not occur with more readiness soon after conception, but is most frequent between the sixth and sixteenth week of pregnancy.

The onset of abortion, or premature labour, is indicated by excessive hæmorrhage ("flooding") from the genital organs after one or more missed menses. If only one period has been missed, abortion might easily be overlooked, and be mistaken for a belated, though rather profuse, menstruation. If the whole of the ovum comes away in the abortion, bleeding generally stops in due time. But often part of the ovum remains behind in the uterus, and then leads to excessive and incessant hæmorrhage with other serious consequences, which may become very dangerous, if not properly attended to. Whenever, there-

fore, there is a suspicion of an abortion, medical aid should be sought. Abortions are too often treated with neglect. They ought to be looked upon in at least as serious a light s confinement, if not more so.

Puerperium.

When parturition is over, woman enters into the state of puerperium, or the "lying-in" period, because she is confined to bed for a certain time in consequence of the effects of parturition. The confinement lasts about ten days on the average, though after difficult labour a prolonged rest of two to three, or even four, weeks is strongly to be advised. At least, no heavy work should be undertaken before the end of this time. For the uterus is still very large and heavy. It takes six weeks or more for it to get back to its previous condition, which process is called its involution. The internal uterine surface presents after the expulsion of the placenta a large raw surface oozing with blood; this has to heal up, as have also the many smaller tears which are unavoidable even in a normal confinement. The discharge of blood mixed with mucus from the vaginal passage is called the lochia, and lasts about a fortnight. After the first parturition the uterus never returns to its previous virgin state, but remains permanently larger in size and less slender in shape. We have already mentioned that the external os is in all cases indented by a scar, the marks of a healed-up tear. Too early rising from confinements often leads to a sinking (prolapse) and inflammation of the womb, with its attendant troubles. A persistent white discharge ("the whites") from the female generative organs is always a sign of local disease.

A normal confinement generally runs its course without any untoward event. The so-called "milk-fever," a

slight rise of temperature on the third day, which is supposed to usher in the secretion of milk, is not an absolutely essential physiological feature, but rather indicates a slight pathological febrile disturbance of the mother. If either during or after confinement great cleanliness is not observed, the large raw surface inside the genital tract may absorb septic germs. The result is blood-poisoning (septic or puerpural fever), which shows itself by high temperature, extreme malaise, and pain in the womb. This is a very dangerous condition, and must be immediately attended to by a physician.

So-called "white leg" or "milk-leg," which occurs during puerperium, consists in a swelling of one or both legs, which assume a pasty and white appearance. It is due to a blocking up of the veins of the affected leg.

The breasts start to yield milk on the second or third day. It is at first of a yellow colour, and thick, and is called colostrum. It has a purging effect on the baby. Soon, however, it assumes its normal constituency. For the first few days the infant loses weight, as it does not at once find its full supply of milk; but the loss is made up after the first week, the gain thence being steady in a healthy and thriving baby. The remnant of the umbilical cord attached to the navel dries up and falls off within the first week or two. The head of the child, even if severely squeezed in the process of moulding, returns slowly to its normal shape. During the first week of the child's life there is often noticeable a yellow discolouration of the skin (jaundice), which passes off again in a few days without treatment. The idea that it only occurs in cases when the mother has turned her back on the child can only be ascribed to popular superstition. Whether moles, birth-marks, etc., of the newly born infant are due to maternal impressions during

pregnancy is still a moot point. While the possibility cannot be totally denied, it must be said that in most cases they are mere coincidences due to the fanciful interpretation of the mother *post factum*.

During lactation menstruation ceases, though not infrequently it returns before the weaning of the child. In fact, in earlier pregnancies its recurrence during lactation is fairly common. The general belief that prolonged suckling is a sure preventative of pregnancy is, therefore, in a good many cases not borne out by facts.

CHAPTER IV

PSYCHOLOGY OF SEX

ANIMAL BASIS

WE have already taken occasion to remark that the best means for a proper understanding of the sex phenomena in man is to trace them back to their more simple animal forms. This we shall find verified once more in the psychology of sex. However high and elevated our idea of human love may be—and in order that love (*i.e.*, sexual love) be truly human it must be spiritual—in the last analysis it rests on the sexual instinct as found among our animal progenitors. No greater mistake has been made in sex matters than the ignoring of this primitive elemental factor of sex, or, still worse, the decrying of it as low, vulgar, and animal-like. Though we have risen high above the brute creation, we must not forget the truth that all living beings are essentially kin in nature. We shall gain a much deeper and better appreciation of the phenomena of sex by learning to view them in their true biological relationship.

1. *SEX DIFFERENCES*

It is customary to divide the sex differences of animals into primary and secondary sexual characters. The first comprise the sex glands, male or female, essential for reproduction, and their respective organs for emission and reception. The second comprise all other distinc-

tive sex characteristics additional to and indirectly connected with the process of reproduction. Here belong the mammary glands of mammals, the stag's antlers, the cock's wattles and spurs, etc. They are those characteristics by which, quite irrespective of the essential sex organs, the male is distinguished from the female in everyday experience. A third class of sex differences, called by Havelock Ellis tertiary sex characters, are those which are less obvious and have no connection with the process of reproduction. These are generally minor points of distinction between the sexes. They are, as we shall see later, small, yet numerous enough to be of importance. No sharp division can, however, be drawn between these three classes of sex differences, it being often impossible to assign a definite place to any given sex character. With some biologists, therefore, it has become more usual to distinguish only two kinds of sex differences—namely: (1) gonadial (appertaining to the gonads, or germ-cells); *i.e.*, in the reproductive organs proper; (2) accessory, the latter being subdivided into those subsidiary to the gonads, such as accessory glands, pairing or egg-laying organs ; and somatic (bodily) differences, such as vocal organs, colour, feathers, spurs, antlers, etc.

There are a great many mammals which show no accessory sex differences, as, *e.g.*, the hare, rabbit, cat, horse, etc., but this is especially the case among organisms much lower in the scale. Here the possession of the sex glands, male or female, forms the only internal indication of sex. In a good many other species, again, the only difference shown is in the size. On the whole, the females are larger among the lower animals, as is seen, for instance, among insects, crusters, fishes, etc. This accords well with the theory of Geddes and Thomson, that the female is anabolic (*i.e.*, conserving and building

up material); while the male is katabolic (*i.e.*, active and spending energy). Among the higher animals, however, such as birds and mammals, it is generally the male that is relatively larger and more powerful. According to the above authors, this apparent exception is explainable partly by the increased vigour of the male due to combats and enhanced muscular stress, while the females are incapacitated by incubation and pregnancy; partly by the

FIG. 46.—BEETLE (*Chalcosoma Atlas*).
Upper figure, male (reduced); lower figure, female (natural size).
(*From "The Descent of Man," by C. Darwin.*)

greater sacrifice demanded from the females of the highest animals on account of their maternal functions.

Coming now to the secondary or accessory sexual characters among animals, we only need refer to the abundant and familiar examples in field and garden. Darwin in his "Descent of Man" has given an unsurpassable account of sex dimorphism as exhibited by the whole animal series, starting with worms and insects

and rising through amphibians and birds to mammals and finally man.

We need only remind the reader of his beautiful description of the sex differences in butterflies, beetles, birds, and many of the higher animals. Such sex differences are either permanent, as, for instance, the horns, crests, etc., of male beetles, fishes, and reptiles, the ornaments, tufts, and other appendages of male birds (see Figs. 46, 47, and 48); or the males assume their sex characters only

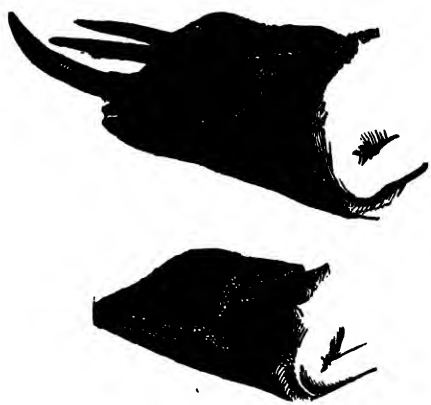

FIG. 47.—CHAMÆLEON OWENII.
Upper figure, male; lower figure, female.
(*From "The Descent of Man," by C. Darwin.*)

during the breeding season. Thus, the stickleback dons his brilliant colour, the stag renews his antlers yearly during the sexual season. Even in those cases where the sex character is permanent, it often becomes greatly accentuated during the sexual season. This applies, for instance, to the plumage of certain birds or the odoriferous glands of mammals.

The sex characters as exhibited by the higher animals hardly give an adequate idea of the whole gamut of sex

difference reached in the animal kingdom. Nor is this difference limited to bodily traits, for specialised difference in structure goes together with similar difference in physiological function. We may mention in this respect the various types of individuals composing a beehive. Here we have a queen-bee, who is the only fertile female

FIG. 48.—BELL-BIRD (*Chasmorhynchus Nivens*). (¼ natural size.)
The adult male shows the ornamental appendage in inflated condition. The young male shows it in flaccid condition.
(*From "Darwin and after Darwin," by G. J. Romanes.*)

of the community, and is fertilised during her one nuptial flight by one male drone, laying eggs during a period of years. This is her sole occupation, as she is fed and tended by the female workers. The drones which occupy the hive are just as helpless as regards their own comfort; they, too, are fed by the workers, and have as their only

function the fertilising of the queen-bee. This happens when the queen-bee swarms, attended by a host of drones. Only one of these attains to the sexual act, and this one dies at the very moment of copulation. The other drones, which do not thus come to live and die for the propagation of the race, are soon afterwards killed by their sister bees, and thrown out of the hive. More in-

FIG. 49.—CHONDROCANTHUS GIBBOSUS (A PARASITIC CRUSTER). (Magnified about 6 times.)

a, Female from the side; *b*, female from ventral surface with male (*F*) attached.

(*From "Textbook of Zoology," by C. Claus.*)

teresting still is the female worker bee; she is much smaller than the queen, and is sterile, her whole business in life consisting in tending the hive and its inmates. In accordance with the bodily differentiation, we find that all these different kinds of bee individuals have their instincts developed in complete accordance with their physical equipment. We meet with a similar arrange-

ment among the ants: here, too, we have fertile females and males, and sterile workers, of which there may be as many as five different kinds.

In many instances the males are diminutive, as in some crusters (see Fig. 49), worms, etc.; and they may even become parasitic, or dwindle out of existence altogether, in which case the species propagates parthenogenetically. On the other hand, we find active and winged males matched by sluggish and wingless females, as happens frequently among insects, such as butterflies, beetles, etc. In some cases the females tend to become parasitic, though this is rarer than male parasitism.

Finally, we must mention the phenomenon of hermaphroditism, already referred to in a previous chapter. A hermaphrodite is an organism which combines in itself both male and female reproductive elements. Such bisexuality is fairly frequent among lower animals—for instance, sponges, corals, worms, snails, etc. It must be noted, however, that in a good many cases of hermaphroditism, as, for example, in the snail, no self-fertilisation takes place. As a matter of fact, the male and female germs ripen at different times, and copulation takes place as in unisexual organisms. Allusion has also been made already to the fact that hermaphroditism is an embryonic stage through which the higher animals pass in their development. In fact, according to some authorities, hermaphroditism must be looked upon as the primitive state among multicellular organisms, the unisexual stage arising later by the predominant development of one kind of sex glands. Others, however, regard hermaphroditism as a later condition superimposed upon primitive unisexuality.

2. *MATING.*

Given two differentiated living elements, male and female, what are the factors which bring them together for the life-producing act of mating? We have already seen that the spermatozoa swarm around the ovum, one finally entering it for fertilisation. What draws the spermatozoa to the ovum? According to the modern biological view, the attraction is due to chemotaxis, that is, the ovum has certain chemical qualities which tend to bring the spermatozoa within its immediate neighbourhood. It must be admitted, however, that the latest experiments in this direction have so far not yielded any positive result. In any case, it is an ascertained fact that there is a tendency amongst germs to select germs of their own kind for mating. Darwin already pointed out that, if pollen of various species was placed upon the stigma of a given flower, this would select with unerring certainty its own pollen. This means that pollen belonging to the same variety or species is prepotent over the pollen of any other variety or species. Thus, hybridisation, or the crossing of distinct species, is generally avoided in Nature, though in breeding experiments the attempt to produce hybrids has frequently succeeded.

We have, then, as the first factor assortive mating, or the mating of like with like. This mode of mating is, of course, purely physical, and remains the only method among all those organisms which shed their sperms into the external world without actual copulation. Gradually, however, an approach is made to mating proper. This occurs, for instance, in some species of fish, where the male accompanies the female and passes the sperm on to the ova as they are deposited, a psychological factor, however feeble, thus being introduced. A further stage

is reached when actual pairing of individuals takes place with a selection of mates. Here sexual mating proper is attained, with evidence of mutual attraction in the mental sphere, leading to a more or less prolonged courtship.

The occurrence of such selective or preferential mating has now become a commonplace of science, ever since Darwin showed its existence with a superabundance of illustrations, not only among mammals, but also among a good many of the lower animals, as insects, crusters, etc. Here we can merely give a rapid survey of the salient points in the various methods of courtship. Thus, it is now established that among many insects, such as moths, butterflies, beetles, etc., the male exhales a strong odour which attracts the females, sometimes from a long distance, and acts as an aphrodisiac which stimulates the females. Among spiders an elaborate process of courtship is gone through, which often ends with the devouring of the love-stricken male by the infuriated female. The stridulation noises made by grasshoppers and crickets, the croaking of frogs, for the purpose of enticing the females, are well known. Nor need we here repeat the story, so often told, of the wonderful ways of mating among birds, where the males generally possess brilliant and often gorgeous plumage, which is displayed before the females in a most elaborate manner. Other birds, again, woo their mates by their song, which is in most cases a characteristic of the males only. The case of the bower bird, which builds a bower and special arena covered with coloured litter, has become classic. In other instances, again, especially among mammals, "mate-hunger" leads to fierce combats among the males, the female looking on and accepting the successful competitor. The many kinds of weapons, as spurs, horns, tusks, etc., are supposed to be due to this process of sexual selection.

Darwin assumed that such secondary sex characteristics distinguishing the males from the females were slowly evolved by sexual selection, the females choosing the more beautiful or more powerful males for mating, this process thus leading to a gradual improvement of the race. But this theory of sexual selection as propounded by Darwin has not met with any widespread acceptance among later biologists. There is no doubt that display and combat take place widely among all classes of animals. What is doubtful, however, is Darwin's special theory of sexual selection, according to which the females are supposed to make a distinctive æsthetic choice from among the males. What takes place, according to more modern views, is a psycho-physiological process, the act of courtship bringing about a state of sexual excitement and physical tumescence in both partners, leading up ultimately to the act of mating. The male is generally the initiator in the procedure of mating, as he is by nature the more active and aggressive. As the sexual desire is, on the whole, less intense in the female than in the male, it needs this preparatory stimulation by courtship in order to be aroused to the full. Courtship acts, therefore, as an aphrodisiac, and forms thus an essential preliminary to the act of mating. This view is still more strengthened by a consideration of the process of mating, as witnessed among the higher animals, including man.

Sexual Season.

It is well known that animals have certain breeding seasons—*i.e.*, that they pair only during a certain period of the year. In spring and in early summer, when the trees and flowers are budding, the birds begin their amours, and build their nests, which are to harbour the brood, the result of their mating. The higher animals,

too, especially the mammals, show a distinct seasonal rhythm in their sexual reproductivity. The sexual season in the higher animals, as rabbit, dog, pig, cattle, etc., is known as the "heat" or brunst period; in males especially, as the rut. Now, as Heape has shown, this sexual season must be divided into two distinct periods — the first stage, called the pro-œstrum, and the second stage, the œstrus. The pro-œstrum is characterised by a congestion of the generative organs; in female animals the vulva and the uterus become swollen, while in many higher animals, as the heifer, mare, bitch, etc., a discharge takes place from the vaginal aperture, consisting of mucus mixed with a lesser or greater amount of blood. The œstrus, or second stage, marks the climax of sexual desire; it is only during this stage that the female will admit the male for copulation. In mammals, as a rule, ovulation occurs regularly during œstrus, and thus leads, if coition is fruitful, to conception. Indeed, it has been shown that in many mammals the process of ovulation is promoted by the act of coition, the latter bringing about a congestion of the ovaries and the Graafian follicles, which leads to their bursting. After œstrus the female organs gradually assume their normal state; there follows the quiet season or anœstrum, which, intervening between two sexual seasons, may be of longer or shorter duration.

It follows from this that an œstrous cycle is made up of a period of congestion (tumescence) succeeded by one of sexual congress, and conception if such should occur. There may be one, two, or more such sexual seasons during the year; thus, the dog, for instance, has two—one in spring and one in autumn. If conception does not take place during any one œstrus, fertilisation is impossible until the next sexual season. Animals which have only one œstrus during the sexual season are called

monœstrous. There are, however, other animals—as, for instance, the rabbit, the rat, etc. — where conception is possible more than once during the sexual season, *i.e.*, if it fails to take place during the first œstrus or heat period, the latter is repeated, and may be repeated in some animals two, three, or more times. The interval between the various heat periods during the same sexual season, which lasts generally only a few days, has been called by Heape the dioestrum, each repeated heat period itself forming a dioestrous cycle with a stage of tumescence and detumescence. In such animals, therefore, a sexual season is made up of a number of dioestrous cycles, each separated from the others by a short dioestrum; while the whole series is closed by a longer anœstrum, until the whole cycle begins again at the next sexual season. Such animals are called polyœstrous. As ovulation takes place only during the œstrus, the repetition of the œstrus during the sexual season seems to have the object of increasing the opportunity for successful coition.

When we come to the Primates, the highest animals, we find that in the apes the dioestrous cycles are arranged over the whole year at regular monthly intervals. In many species a proper menstrual flow occurs, just as in the human female. There is, however, this distinction: that while the human female is capable of conceiving throughout the year, in apes, as in the gorilla and chimpanzee, there still occurs a special breeding season, during which alone ovulation takes place and conception is possible. The cessation of menstruation here is followed by a distinct œstrus and sexual congress. In woman, too, ovulation is said to take place most frequently after menstruation; at least, it ushers in the period of greatest sexual desire, and is said by some authors to be the commonest time for fertile coition. It follows from this that the menstrual

period corresponds, not to the whole heat period of animals, but only to its pro-œstrous stage; furthermore, there is a good deal of presumptive evidence that primitive man still had a definite sexual season. In the first instance, there still exist primitive races among which propagation is restricted to special seasons of the year. Further, the annual feasts of the ancients, coupled with great sexual licence, have most probably the same significance. Even in modern society, the time of the greatest number of conceptions (if not altered by other social or economic factors) coincides in most countries with the spring or beginning of summer, though the human female is now capable of conceiving at any time of the year.

It used to be held that menstruation in woman is a sort of preparation of the uterus for the attachment of the fertilised ovum, and that menstruation takes place when conception has failed to occur. According to this view, "women menstruate because they do not conceive." But this opinion is now held only by a few authorities. We must rather look upon menstruation as corresponding to the pro-œstrum of the lower animals, a process of tumescence, which in the case of woman has assumed a somewhat excessive and nearly pathological form. Indeed, Metchnikoff viewed it as one of the constitutional disharmonies of man's generative system.

As to the cause which brings about heat and menstruation, it is most likely that an internal secretion furnished by the ovaries is the exciting factor. For menstruation and heat cease in female animals whose ovaries have been removed.

CHAPTER V

PSYCHOLOGY OF SEX—*Continued.*

MAN AND WOMAN.

We have thus far given a short survey of the sex phenomena as they appear among animals, and found that they gradually lead up to the manifestations of sex as seen in man. This point has to be kept well in view whilst dealing with the psychical aspect of the human sex impulse. For it is here especially that prejudice or predilection tends to warp our judgments. The primary biological factors of sex in man are so overlaid with a complex fabric of social tradition and custom that it is difficult to arrive at its real significance. Only an unbiassed study of all available scientific data will help us towards a proper understanding of the respective spheres of man and woman. To attain this end, we must first of all consider the physical differences of the two sexes in man, so far as they express a fundamental distinction between the male and female organisation.

The most striking feature distinguishing man from woman is, of course, his greater size and strength. The motor energy of man is at least a third greater than that of woman. His greater power and activity is shown not only in the more strongly built limbs, but also in the relatively greater chest development. In woman, on the contrary, the abdominal and pelvic regions are comparatively larger, the vegetative and reproductive functions

playing a more important rôle. This tendency of woman is indicated by the greater amount of fatty tissue developed by her, which gives the female figure its beautiful roundness and swelling curves, in contradistinction to the muscular development of man with his rugged outlines. Though woman is of smaller stature than man, she attains her full height at an earlier age; indeed, there is a period before puberty when girls are actually taller and heavier than boys of the same age. Puberty is reached earlier by woman. But this is not all. In many respects the female remains nearer the infantile type, while man, during his development, approaches more the simian (ape-like) and senile type. This greater youthfulness of woman shows itself in many ways. Thus, the child possesses a relatively larger head and abdomen, but a relatively smaller chest, limbs and face than adult man. In all these points woman is nearer to the child, as also in the more infantile formation of the skull. But this relatively early arrest in growth cannot be interpreted as an inferiority in woman. On the contrary, it has been shown that, just as the young ape is in comparison more human than the adult ape, so the human child is really in advance of the human adult type, which retrogresses somewhat with age to the simian and senile form. In this respect woman leads in the evolution of the race, and man follows.

The most distinctive secondary sex characters of woman lie in the pelvis and the breast, features which are closely bound up with her reproductive function. While the male pelvis is long and narrow, the female pelvis is widened out, the brim being broad and its lower parts more open and separated. This, of course, is an adaptation to the function of child-bearing, a wide maternal pelvis being essential for the birth of the human child, with its large head. Indeed, it has been established as

a fact, that the higher the race of man the larger the female pelvis; that is, the differentiation of the sexes as expressed by the female form increases with civilisation. The development of the breast in woman is, of course, an adaptation towards the same end; for suckling is the natural function of a mother.

There exists also a distinct difference in the general metabolism of man and woman. We have already found it a general rule that the male is more active, or katabolic, the female more passive, or anabolic. Now, this has its cause in the different composition of the blood in the two sexes. The blood of man has a higher specific gravity and contains more red blood-corpuscles; the blood of woman is more watery and contains less iron, the iron, as Bunge suggested, being stored in the maternal organism even before the first pregnancy, ready for use for the fœtus. This accounts for the tendency to anæmia and chlorosis shown by growing girls. Altogether, the rate of metabolism is lower in woman, her vital capacity less. On the other hand, she bears illness and injuries better, and has a longer life.

In accordance with these physical differences between man and woman, we find corresponding physiological and psychological characteristics. Man's physiological reaction—*i.e.*, his response to sense-impressions—is more rapid and precise than woman's. Thus, man's activity shows a higher working power, it is quicker and at the same time more effective. Man is capable of powerful spurts. Woman, on the contrary, works at a lower level, but her output of energy is more continuous; she tires less quickly than man.

Coming now to mental characteristics, we find as an outstanding womanly trait the great impressionability of the female mind—its "affectability," as Havelock Ellis has called it. Thus, though women have not, on the

whole, a finer discrimination of sense-impressions, they respond much more quickly to new stimuli, and make fresh adjustments more readily. Altogether, women are more excitable and emotional than men. Thus, they are more amenable to hypnotic suggestion, and more liable to convulsions and hysteria. The lesser forms of nervous excitations are also more frequent among women, such as blushing, weeping, laughing, etc. Their nervous organisation is less stable; they respond readily to new stimuli, but become exhausted quickly, thus showing a lack of staying power like children and primitive man. This greater affectability of woman has, of course, also its good side. Thus, women adjust themselves much more easily to new circumstances than man. They have a quick, intuitive apprehension of facts, are more nimble in mind and more resourceful. At the same time, women show less variability than man; they do not reach extremes so often, either of genius or of idiocy. They thus show a greater racial stability, tending more to the norm. This, together with their more passive nature, which inclines them to endurance and self-sacrifice, makes them "in form, function, and instinct, restful to men tortured by their vagrant energies." In short, woman, being nearer to the child, is nearer to Nature, and forms the best *pendant* to the ever-active, striving, restless male. The differentiation of the sexes in their mental respects is thus in full conformity with their respective shares in the reproductive functions. This fundamental distinctive trait of the sexes finds further corroboration in the erotic differences of man and woman.

We have already seen in a previous chapter that it is, as a rule, the male who is active and roaming and seeks the female during mating. The female, on the contrary, plays a more passive rôle, and waits to be wooed. But here a more complex factor is introduced. For the

female does not yield immediately, but plays a sort of game of refusal and acceptance. This coyness, characteristic of the human female, is the psychic equivalent of the more primitive instinct, as observed among animals. For the female animal admits the male only during the heat period, and refuses him at any other time. This playfulness, which has its rôle during courtship, tends to heighten the erotic emotion, and thus enhances the process of tumescence in both partners alike. The same emotion is the germ of modesty as developed in the human species. Modesty has, in fact, become one of the most distinctive secondary sex characters of woman. Coquetry, too, a typical feminine trait, is but the social form of the same instinctive female behaviour, and is thus of deep biological and psychological significance. The woman has to be aroused in order to be amenable to passion and love, and it is the task of the male to arouse her. In fact, it may be said, the amatory contest serves the purpose of sexual selection in man.

The aggressive attitude of the male shows itself also in his love for domination, while, once more, the passivity of the female expresses itself in submissiveness and abandonment. This relative passivity of woman has given rise to the idea that the sex instinct of woman is weaker than that of man. But, as Havelock Ellis has pointed out, the passivity of woman as regards the sexual impulse is only apparent. This misconception is due to several facts. First, the sexual impulse in woman tends to develop at a later age than in man; secondly, it remains generally diffuse and in abeyance until it is aroused by love; and, thirdly, woman is capable of submitting to the sexual act in complete passivity. But this last state is by no means the normal one. We have already pointed out that woman takes a relatively active part in the sexual act. In order that she may derive

the pleasure of complete orgasm, a proper state of tumescence must be produced in her, which is only possible by appropriate excitation. As a matter of fact, man reaches the climax very much sooner, the orgasm in woman being attained more slowly. Her sex feeling is altogether more diffuse, more extensive, while in man it is intensive, focussed, as it were, in a single point. For this reason, the sex impulse in woman is in need of stimulation. And we must add, as love in woman takes on a more psychical than physical aspect, it is not every man that is capable of rousing the right emotions in a given woman. In fact, while man's sexual impulse may be said to be centred chiefly in the sex act, with woman it is the consequence which is of vital importance. There exists, as Walter Heape has expressed it, a fundamental antagonism between the sexes in this respect. While the male, with his craving for passion and change, has subjugated the female to his own ends, woman, being first and foremost a mother, has built up the family system, and in her turn bent man to her interests. We see here once more the elementary difference in the reproductive organisation of man and woman. To man "love is an episode"; to woman it is her whole life.

But our study of sex can be pushed still a step farther. We have seen so far that the sex characters of a given individual are determined by the activity of the appropriate sex glands, male or female. According to modern theory, this is due to the internal secretions of the sex glands, by which certain substances—the hormones—are thrown into the body circulation. Man and woman have each a differently balanced metabolism, which influences their whole physical and psychical activity in different directions. This becomes apparent at once in those cases where pathological or surgical interference with the sex glands disturbs the typical sex characters of the

individual. Thus, it is well known that castration of animals—*i.e.*, the removal of the testicles or ovaries—before puberty prevents the development of the typical sex characteristics of the animal. Thus, caponisation, or the removal of the testes in fowls, leads to arrested growth of the combs and spurs in the cockerel; stags, if castrated when quite immature, do not grow any antlers; eunuchs retain their youthful high voice, etc. While castration in males inhibits the development of their typical sex characters, castration in females leads to the ppearance of the opposite male characters, as has been shown in many species, including man. Complete removal of the ovaries in woman brings about atrophy of the uterus, stops menstruation, and often produces mental disturbances. It has been possible in such cases to transplant living ovaries into the organism, with the result that the effects of castration were considerably mitigated. During senility, too, when the sex glands cease functioning, effects similar to those after castration can be observed. Thus, old hens have been known to assume the spurs and the plumage of the male; women after the menopause often incline towards the masculine type, the skin becoming coarse and hair developing on the face.

But our survey of the causative factors of sex is by no means complete. For it has been found that the secondary sex characters are not dependent only upon the essential organs of reproduction. Indeed, it has been shown by experiments that in some insects and crusters the generative organs have no such influence upon the development of the secondary sex characters as in the vertebrates. But more still, even among mammals, including man, it is now a recognised fact that the sex ensemble of a given individual is not due to the gonadial secretion only. "Sex is not limited to the sex organs, but pervades the whole body." Thus, Blair Bell has enunciated the thesis that "the reproductive func-

tion is directed and controlled by all the organs of internal secretion acting in conjunction." There exists, according to this authority, a correlation of all the internal secretions in regard to the sex functions, which has been called by him the "sex-complex." Thus, *e.g.*, it is a well-known fact that there is a close connection between the thymus and sex development. This gland, situated in the neck below the larynx, atrophies during puberty; and it has been demonstrated that its excision is followed by rapid development of the genital gland. On the other hand, the removal of the thyroid or the pituitary glands has as a consequence the atrophy of the female genital organs, while the removal of the pineal gland leads to precocity in the male. Furthermore, it has been shown that in hermaphroditic human individuals the secondary sex characters do not necessarily coincide with the sex as indicated by the genital glands. Here not only are the external sex characters opposed to the character of the gonads, but the erotic emotions are also those of the opposite sex. Indeed, it would be more correct, according to Blair Bell, to determine the sex of such an individual, not in the usual way, as coinciding with that of the sex glands, but according to the general anatomical and psychic make-up of the person. Such cases show clearly the dependence of the psychic attitude of the sex individual upon the general metabolic tendency of the organism, as expressed by the aggregate activity of all the organs of internal secretion.

In fact, we must assume that there is no such thing as absolute femininity or absolute masculinity. The total femininity or masculinity varies in different individuals. When any of the masculinity-producing internal secretions become abnormally active in woman, the ovarian secretions are antagonised or inhibited. Women of this type will show a more than normal share of masculinity. Indeed, these latest discoveries in the causation of sex

give a good deal of countenance to the sex theory propounded by Weininger. According to this author, the sex characters of an individual are always mixed in varying degrees. There exist innumerable gradations of sex, and we must recognise intermediate mental types. Thus, there are some women who, with their ill-developed breasts, their hairiness, their large limbs, and their aggressive mind, tend towards the masculine type; while, on the other hand, the feminine tenderness and intuition of some men clearly shows them to possess a strong admixture of femininity. We are, therefore, not longer justified in regarding woman simply "as man of smaller growth." On the contrary, as Walter Heape maintains, "the male and the female are complementary; they are in no sense the same," though, it should be added, they have, of course, the same social value.

These results are borne out also by a general consideration of the sex problem. From one point of view we may look upon the reproductive system as the essential system of the organism, in the same way as Weismann has regarded the germ-cells as the continuous bearers of life, the body being only "something temporary and non-essential, destined merely to carry for a time and nurse" the more important germs of the future generation. In accordance with this, we can say with Blair Bell that, in the scheme of evolution, the individual life only serves the end of reproductive life. And man and woman are differentiated in accordance with this scheme of life. Woman, bearing through biological necessity by far the larger share in the process of reproduction, devotes her main energies to the purpose of motherhood and the family; while man, taking a more passing interest in the actual process of propagation, is set free to employ his powers towards providing the future generation with the comforts and luxuries of life.

CHAPTER VI

ABERRATIONS OF SEX

We have repeatedly had occasion to draw attention to the fact that the erotic feelings of man have their roots in the more elementary phenomena of sex as witnessed among the animals. Here we have to lay stress upon the obverse statement of this fact. It is a trite observation that, though man is an animal and thus shares his primary physiological functions with his progenitors, he has at the same time risen far above the brute creation. The acquirement of the higher psychic qualities has added a spirituality to man which, whilst being reared upon an animal basis, seems to transform his very being. And this must never be forgotten—especially as regards sex. The sex impulse of the mere animal has been taken up into the higher form of human love. Love, as a sex phenomenon, may be defined as a feeling of physical and spiritual unity between two persons of opposite sexes. To the physical desire in man there are linked emotional and æsthetic impulses which transmute the gross animal nature into an experience which forms the choicest flower of humanity. As we shall see in the following, it is the separation of the various factors of human love which brings about the aberrations of sex.

1. *AUTO-EROTISM.*

Auto-erotism is a term used by Havelock Ellis for all those phenomena of the sex impulse which, instead of

flowing towards another person, are abnormally centred in the self. As the self may be the bodily or spiritual self, the term includes not only the gross forms of sexual aberration, but also those finer sexual efflorescences of a religious and æsthetic nature which may be said to form the basis of some of the highest religious and artistic efforts of the world. It is not for us here to deal with the latter forms of auto-erotism. As regards self-abuse, we shall give only the more salient facts of the subject—a subject which, remaining unnamed, is generally shrouded in awe and mystery for the young, and thereby produces more mischief than a candid elucidation of the truth ever will do.

We must remind the reader that the process of tumescence is dependent on two factors, a physical and a psychic one. On the one hand, tumescence is brought about by the physical excitation of the sex organs and other erogenous zones—*i.e.*, parts of the body (lips, breasts, etc.) which have special sexual sensitiveness. On the other hand, there enters into the process a mental factor of voluptuousness and desire which under favourable conditions provokes and enhances the orgastic feeling; while under conditions of aversion it may inhibit and make impossible the sexual act. We have accordingly auto-erotic phenomena of two kinds. Those which are purely physical consist of manipulation of the sex organs imitating more or less the natural process of sexual excitation. This is called self-abuse, masturbation, or onanism. Secondly, there are the voluptuous thoughts, day-dreams, erotic dreams at night, etc., which often bring about actual physical orgastic feelings. In man such a state of pent-up desire may produce nocturnal seminal emissions which, if not too frequent, must be regarded, in the absence of other sexual gratification, as more or less normal. It is otherwise with

deliberate self-abuse. Here we must distinguish between the normal and the pathological aspect of the problem.

It has been the custom until lately to decry masturbation as a heinous sin which brings in its train the most direful consequences. Now, it cannot be gainsaid that the diversion of the sexual passion into the auto-erotic channel denotes in every instance a misdirection of a natural impulse, and is in so far wrong. But it must be remembered that masturbation often starts in childhood through some physical irritation, where no moral stigma can be attached to the act; and the same may be said of many cases where the habit originates in youths before maturity. It may perhaps be going too far to assume with Freud an infantile sex impulse; but, as Metchnikoff has pointed out, there exists a disharmony between the precocious development of the sexual sensation and the development of sex maturity in man, leading to self-abuse, which, while abnormal, cannot be considered unnatural. Furthermore, in the face of the imperative call of the sex impulse after puberty, we must not forget that, if every other avenue of sex gratification is closed, the individual will naturally resort to practices which are nearest to hand.

The bad consequences of masturbation have been greatly exaggerated, and opinion nowadays leans to a much more moderate view of the evil. In the first place, we must discriminate between a sparing amount of self-abuse and excessive indulgence. The latter tends to be harmful, like any other excesses *in venere*, and must be adjudged separately in every case. It has been found that, on the whole, the consequences of moderate masturbation are from a medical point of view negligible. It is more from its effects in the mental and moral spheres that it gains its importance. Here it cannot be denied that the malpraxis often produces baneful effects.

Neurasthenia and other nervous disorders are a common concomitant of masturbation. But while some authorities would blame masturbation as the cause of these diseases, others are more inclined to look upon both as the consequence of a weak hereditary predisposition. In any case there can be no doubt that a persistent auto-erotic habit tends to pervert the normal sense of sex gratification, and thus may bring about, in the end, sexual impotence. The moral effects are no less grave. Solitary self-abuse, which misses one of the most potent factors of erotic elation—the charm of the partner of the other sex—must ultimately lead to a morbid habit of thought. But here again it must be emphasised that a good deal of the mischief done is due to the ignorant zeal of would-be moralists, who, as Havelock Ellis points out, "have raised masturbation to the position of a colossal bogie."

A sane view of the subject will avoid exaggeration in both directions. Whilst admitting with Havelock Ellis that masturbation is often a means of obtaining "relief for physical oppression and mental obsession," we must, on the other hand, agree with Edward Carpenter that "to prolong the period of continence is to prolong the period of growth. . . . To introduce sensual and sexual habits—and one of the worst of them is self-abuse—at an early age is to arrest growth, both physical and mental. And what is even more, it means to arrest the capacity for affection. All experience shows that the early outlet towards sex cheapens and weakens affectional capacity."

2. *EROTIC SYMBOLISM.*

Love, we have said, is due to a sex attraction, partly physical, partly psychic. The erotic impulse is not something simple, but is, as Freud has pointed out, a complex composed of many elements. It is the detach-

ment and accentuation of the separate factors during the sexual process which brings about the various forms of abnormal sex relationship. In order, therefore, to understand these, we must go somewhat deeper into the analysis of the erotic emotion and its component parts. Here, as in so many other fields of sex psychology, Havelock Ellis's pioneer researches have set the standard.

There are first of all the elementary bodily sensations, which play a considerable part in the process of courtship. The sensations of touch, smell, hearing, and sight, are powerful aids to tumescence, arousing and enhancing the sexual emotion. Touch is the most primitive sense in the animal world; and, indeed, the act of coition itself may be looked upon as a heightened orgasm of touch. In addition to the sex organs themselves, there exist other erogenous zones of the body which have a special sexual sensitiveness and which, when excited, easily lead to sexual erethism. These are (in addition to the breasts, which are intimately connected with the generative system) the orificial parts of the skin at the entrances and exits of the body—namely, the mouth, anus, etc. This accounts for the voluptuous feelings aroused by kisses. And even the transgression of the kiss into unwonted regions, if subordinated to the whole process of courtship, can hardly be looked upon as something pathological.

The sense of smell, strongly developed in animals, and forming the chief sexual excitant among mammals, is largely atrophied in man. But even here it has not entirely ceased to play a rôle as an aphrodisiac, as witness the perfumes so much indulged in by women. Odours, either natural or artificial, often give rise to voluptuous sensations, the armpit forming the chief olfactory centre of attraction.

With regard to sound, we need only refer to the fact

already mentioned, that song forms a frequent source of allurement among birds. In man it is not so much music itself, but rather the rhythmic motion of dancing, which has a close connection with the sex process. The erotic dances of savages used for the purpose of producing orgastic feelings have their faint counterpart in the modern dance, which is one of the commonest methods of satisfying the erotic emotion in both sexes.

Coming to the sense of sight, it forms the most essential æsthetic element of the sex feeling; for human beauty, considered objectively, is nothing but the secondary sex characters of man and woman erected into a type. The artistic admiration of the woman's body, with its swelling curves of hips and breasts, is due in the last analysis to sex attraction. No wonder that it retains to the full its primitive charm for the enraptured lover.

In healthy love there is a concurrence of the various factors, which all combine to create an ardent desire for the possession of the beloved. Its finer and spiritual essence will, of course, vary with the psychic and moral endowment of the persons affected. Now, in erotic symbolism, as defined by Havelock Ellis, the normal tendency to idealisation, characteristic of the erotic emotion, limits itself to one special point. A given physical feature or a passing act in the process of love is, as it were, lifted out of its context, and assumes undue prominence to the exclusion of the other factors. It is made symbolically to stand for and in place of the whole sexual act—in short, becomes a sexual fetish. What ought to be only a subordinate incidental part of the sex process now appears as the sole end and final aim of perverted love.

We hardly need to go into many details about these perversions. We shall only mention a few of the more obvious cases. Thus, there are persons, mostly male,

who find erotic satisfaction in the contemplation of the footgear, and footgear only, of the other sex; or those who have an excessive attraction to woman's hair, of which they sometimes may try to get possession by criminal acts. There are others, again, who take delight in the handling of certain stuffs, mostly furs and velvets; others have a mania for women's handkerchiefs, which they do not hesitate to get hold of even by theft. Even worse perversions, centring around the excretory functions, are found, all due to a morbid intensification and misdirection of the sensuous feelings, leading to abnormal sexual desires.

There is only one other perversion upon which we have to dilate somewhat. This is the rather common, though abnormal, tendency of procuring sexual voluptuous feelings by the infliction or sufferance of pain. This has been termed algolagnia (*algos*, pain; *lagnos*, sexually excited), and may take two forms, though in certain cases they appear combined and cannot always be clearly distinguished. Active algolagnia or sadism (named after the Marquis de Sade, who first dealt with this phenomenon in his writings) is the lustful impulse to cruel and violent treatment of the opposite sex; while passive algolagnia or masochism (called so after Masoch, who largely represented this type in his novels) is the opposite tendency to derive sexual pleasure from the endurance of such treatment. In this case, too, the abnormal can be traced back to the normal, the former being merely the morbid exaggeration of a particular trait of courtship.

We have already had occasion to point out in a previous chapter that courtship among animals often takes the form of combats, which are more or less real. It is here that the male propensity to overpowering domination makes itself felt, the use of force often being essen-

tial for successful propagation. The female, on the other hand, derives a certain satisfaction in submitting to the rough play during courtship, and comes to associate sex emotion with a certain amount of pleasurable pain. In fact, according to the physiologist Burdach, "it is the alliance of pleasure with pain which constitutes the voluptuous emotion." This female characteristic still comes out very clearly in some less civilised people, where the woman takes severe punishment from her husband as the surest sign of affection. Furthermore, it has been found that, while, in general, man admires woman for her beauty, a static quality, woman is more impressed by the physical strength of man—*i.e.*, a dynamic quality. It would thus appear that the display of a certain amount of brute force during courtship is normal; in fact, it increases the intensity of the emotion during the process of tumescence. In its extreme pathological form, however, as sadism and masochism, it can only be looked upon as a relapse into the more primitive animal state.

3. *SEXUAL INVERSION.*

The perversions so far dealt with were built upon the basis of the normal sex instinct, being, as it were, only one-sided excrescences of it. They are generally due to chance influences during the lives of persons who, though often of a psychoneurotic constitution, are otherwise normal. For, as Freud has pointed out, if there is something congenital at the basis of perversions it must be accepted as a normal predisposition in all individuals, which only needs special favourable circumstances in order to be brought into prominence. The case stands somewhat differently with sexual inversion. Here we have an abnormality which, according to the most authoritative modern opinion, must be looked upon as due

to an inborn variation of the sex instinct While normal love turns naturally towards persons of the other sex, the invert is by inborn constitutional abnormality attracted towards persons of the same sex. This phenomenon is also termed homosexuality (*homos*, same), in contradistinction to heterosexuality (*heteros*, other), the normal sex feeling for the other sex. It must be made clear at the outset that so-called unnatural practices, often found in prisons, barracks, and other places where normal sex relationship is impracticable, are not included here under this term. Such perversion is rather due to the accidental corruption of normal persons, and has been termed pseudo-homosexuality. In most cases of this kind it is only a temporary aberration, a surrogate for unsatisfied normal sex feeling, and is generally given up again as soon as normal sex relationship is established. The feeling of the true invert, however, can only be compared with real emotional love; it shares all the characteristics of an ardent affection, often of a very deep and romantic kind. For the male invert feels in sex matters like a woman, and the female invert like a man.

The physical characteristics of the invert do not deviate very much from the normal. It is true there are many male inverts who approach the feminine type, and female inverts often show masculine traits. There seems to be a tendency towards youthfulness of appearance in both sexes. But, on the other hand, many male inverts are thoroughly virile, and would not be specially noted in a crowd. It is in the psychic make-up that the invert differs so much from the normal individual. Here the homosexual tendency finds its counterpart to a large extent in the mental disposition. The male invert, or uranian, as he is also called, possesses a sensitive female mind, and is often of an emotional artistic temperament. It is this which makes him so peculiarly

fitted for certain vocations, such as acting, *belles-lettres*, humanitarian activities, etc. The invert is not necessarily a degenerate, but, on the contrary, is often of a very high intellectual and moral standard, and his only fault is that he does not feel in sex matters like other people. Some of the foremost men of the world have belonged to this type.

Strange as sexual inversion appears, isolated as it seems from all normal facts of sex life, it is by no means quite unconnected with the basic phenomena of sex. There are no sharp divisions in Nature, and the subject of sexual inversion proves this once more. In the first instance, it has been shown that the sex instinct before adolescence is by no means definitely directed towards the other sex. There exists a period of undifferentiated sex emotion which may not only miss a sex objective altogether, but may remain uncertain in the sex of its object. Juvenile pederastic (man-to-man) practices may be the result of this undeveloped sex sense; or it may find vent in a most fervent, romantic friendship, as can often be noticed among the young of both sexes, without a trace of physical love. Indeed, as Edward Carpenter has pointed out, "love and friendship are in reality closely related, and shade imperceptibly into each other." Such attachments, when not actually leading to homosexual practices, cannot be classed as wrong in any sense; they only serve the wholesome purpose of using up excess emotion during the years of growth, before sexual love itself asserts its full rights. In neither case is there necessarily any connection with inborn homosexual propensity.

As to the explanation of sexual inversion, we must refer the reader back to the theory of sex. We have seen that, according to the latest authorities, sex is not so much determined by the character of the sex glands

as by the whole sex-complex of the internal secretions. There is, therefore, the possibility given of a person possessing the sex glands of one sex (testicles or ovaries), and yet exhibiting characters of the other sex. But the dictum of Ulrichs, (himself a uranian), that in the male invert a female soul co-exists with a male body, is at once too far-going and too simple. It goes too far in assuming a female soul within the uranian; for he is only a female in respect of his sexual desires and feelings. Otherwise he may be quite normal, or may exhibit feminine traits only in particular directions. The admixture of a certain amount of femininity is by no means rare in man, as we have pointed out before, and does not in any way imply in itself any abnormal tendency. It is the feminine sex feeling which distinguishes the invert from the feminine man, and it is with regard to this point that Ulrichs' solution is much too simple—if it is a solution at all.

What is the cause of the homosexual feeling in the invert? We have seen in a previous chapter that there occurs a stage of hermaphroditism in every individual during embryological development, and that even in the adult a mixture of psychic masculine and feminine qualities must be taken to be the rule rather than the exception.. Now, there are persons who exhibit inversion in a sort of transition stage. While the normal person is heterosexual, is attracted toward the opposite sex only, there exist a number of individuals in whom the sex impulse is bisexual—*i.e.*, it may be directed towards either sex. According to Havelock Ellis, however, most of these cases prove to have a preference for their own sex, showing thereby that the bisexuality is really a milder form of homosexuality. We can view the sexual inversion, in agreement with the general theory of sex, as a sort of psychic hermaphroditism, an innate distur-

bance of the normal sex-complex, due to a redistribution of the normal male or female hormonic balance.

We cannot close this subject without alluding at least in passing to the social problem of the invert. At present the law punishes all homosexual practice severely. This is, in view of the inborn nature of inversion, which may take on the sublimest form of worship, as cruel as it is futile. It is estimated that about one to two per cent. of the population is actually born with this anomaly. We ought to treat the inverts, so long as they do not corrupt healthy people and avoid public scandal, in the same way as we treat other abnormal persons, say those suffering from colour-blindness or deaf-mutism. Whilst agreeing with those who urge against the wholesale condemnation of a whole class of unfortunate, otherwise often most worthy people—which is only a relic of medieval ignorance and prejudice—we must, however, not fall into the opposite error, often perpetrated by enthusiasts, of extolling the homosexual temperament, with its double sexual gift, as equivalent with normal sexual love. However valuable the invert may be as a social force on account of his peculiar qualities, we must not forget that the same combination of masculine and feminine characters is frequently found in men who have no trace of homosexuality. In fact, it has often been observed that a dash of youthfulness and femininity is typical of the genius. Nor can we look upon homosexual love as equivalent to normal love. The former is and must remain barren; but love from a biological and social point of view, however justified and beautiful in itself, has after all another, not less important, function in life—namely, procreation. It is this which gives wedded love a zest and aim which homosexual love can never attain.

CHAPTER VII

THE SEXUAL NORM

HAVING given the fundamental facts of sex life, we are now in a position to formulate the sexual norm—*i.e.*, the normal behaviour of the healthy individual during the sex process. It is too generally taken for granted that this can be determined by moral and social considerations alone. What a person ought to do in sex life according to a preconceived ethical standard is confused with the usual, much more pertinent problem of what the average person can do according to the physiological sexual rule. And yet these two notions must be kept clearly distinct. For while we cannot gainsay the ethical postulate that the sex life must be in agreement with the general moral law of society, there is no doubt that only mischief can result if such ethical demands are not in conformity with the physiological laws of sex. It is no use complaining that "nature will out," when we have been foolish enough to try and expurgate nature. It is our business to understand Nature and order our lives in accordance with her behests. "We can only command Nature by obeying her." And this applies with special force to the sphere of sex, where the theological and social tradition of centuries has led to a habitual disregard of the elementary factors of sex, and therewith to a false standard of sex life.

1. *THE PROBLEM OF CONTINENCE.*

It is the idea of continence which has suffered, perhaps more than any other sexual problem, from the confusion of the ethical with the physiological norm. Starting with the assumption that all sexual desire is, by its very nature, of the flesh, and therefore "beastly," the medieval Church did not hesitate to proclaim the ascetic ideal as the aim of life. Sex gratification was only allowed as an act of grace, as it were, in matrimony, which had to be specially consecrated for this purpose. This mode of thought still reverberates in the opinions expressed by certain purists who maintain that abstinence outside marriage—under all conditions, without any qualifications whatsoever—is the only possible standard of virtue, little or no heed being given to the problem of abstemious behaviour in married life, which is here just as essential to a high moral tone as it is outside legalised marriage. In order to substantiate their position, the partisans of this school of thought have endeavoured to bring forward scientific evidence in order to prove that abstinence —*i.e.*, total abstention from sex gratification—is not only possible, but from a medical point of view harmless.

Now, it cannot be doubted that, as regards the former point, there are a good many individuals who are able to withstand the temptation of sex and lead a pure life. It is just these persons who never fail to insist upon their mode of life as the only righteous one, the one which is attainable and ought to be attained by all. These good people forget that, just as in other human traits, there exist considerable variations in the promptings of the sexual impulse, and that we must allow for such differences in sex matters as much as in other affairs of life. It will not do to attempt to force all sexual temperaments into the same bed of Procrustes.

It is true that in the average case abstinence—which must be clearly distinguished from continence—does not lead to any grave disturbances of health; in the majority of instances no serious physical ill-effects result. But in saying so we have not stated the whole case. For there are some individuals, and not a few of them, in whom abstinence produces mental depression, lassitude and inability to work. Sometimes, as Professor A. Nyström has pointed out, nocturnal or even diurnal emissions will ensue from prolonged abstinence, which lead to a weakening of the sexual nervous apparatus, and may ultimately bring about impotence. Women, being more passive in their sex lives, bear sexual abstinence, on the whole, much more easily, especially if the sex passion has not been aroused in them by actual experience. Besides, frigidity—*i.e.*, a natural coldness towards sex relationship—is a much more frequent occurrence among women than among men. The female need for sex gratification would therefore be much smaller. But even here a dogmatic attitude can by no means be maintained. The erotic impulse can be largely sublimated—*i.e.*, directed into other channels of an intellectual, emotional, or æsthetic nature; but there generally remains a residuum which cannot be disposed of in this manner, and often leads to unexplainable oppressive yearnings and desires, both in man and in woman. Even physical exercise, so frequently recommended as a panacea against sexual promptings, has by no means always the desired soothing effect. If not pushed to excess, thus producing general bodily exhaustion, it may, on the contrary, by the general heightening of the vital energy, stimulate the sex centres; for these are, after all, not an isolated system of the body, but are influenced in consonance with the whole bodily tone.

But the medical aspect of abstinence is, in any case,

beside the question. Our problem is not so much whether abstinence is unprejudicial to health, but whether, as a matter of fact, it is possible. Before deciding this point we must first be careful to define what is meant by abstinence. For, according to the generally implied view, abstinence merely seems to mean abstention from sexual intercourse with the other sex. But, as Rohleder has truly remarked, have we a right to speak of abstinence if we do not exclude at the same time all other sexual practices of whatever kind? There is no doubt that sexual abstinence is often accompanied by masturbation or other perverse practices. Furthermore, it may be regarded as a rule that erotic dreams and voluptuous reverie form the psychic counterpart of physical sex gratification in all normally constituted persons. A person not so affected would have to be classed, according to Rohleder, as an individual suffering from sexual anæsthesia. Therefore, speaking of abstinence can only imply partial abstinence in the sense indicated.

If we desire to solve the problem whether such abstinence is at all possible, we must differentiate between abstinence of the male and of the female. Women, as we have already seen, are certainly less prone to become victims of violent sex impulses—at least in the earlier period of mature life. In fact, masturbation in women has been found prevalent mostly between the ages of twenty-five to thirty-five years. It is at this time, it appears, that sexual needs tend to become imperative in woman. The case stands otherwise with the male. Here all forces combine towards an early excitation of the sexual instinct. This is so much recognised as a social fact, that the problem of sexual continence may be said practically to be a male sex problem. But though the unruly sexual spirit of man is admitted as a fact on all sides, it is attributed by the orthodox sex reformers

to premature and excessive artificial stimulation under conditions of civilised life. While this must be granted to a considerable extent, it nevertheless does not convey the whole of the truth. Professor Groos and others have shown that a sort of sexual play occurs even in childhood, and must be looked upon from a biological point of view as a preparation for adult life, in the same way as other play activities of man and animals. We cannot attribute to it in the majority of cases any corrupt taint whatsoever. Sexual proclivities are also freely indulged in in a natural manner by the young of many primitive tribes, and also among the rural population of civilised countries. As Metchnikoff has pointed out, it is one of the disharmonies of human life that the sexual impulse develops in man before full maturity is reached. The impulse towards sex gratification must therefore be looked upon as natural in the same sense as any other human impulse. There is no reason to assume that it can remain in abeyance beyond a certain period of life. Nor can it make any difference to the sex instinct of a man whether he happens to be married at a certain age or not. For in both cases, if the proper age is reached, the craving for the other sex will strive for appropriate satisfaction. As Freud has said: "Experience shows that the majority of people forming our society are constitutionally unequal to the task of abstinence." And we would endorse this dictum, adding only that what we here mean by abstinence is the total suppression of the sex impulse in all its forms. The lustful propensity of the male in matters of sex shows itself in more than one way. Thus, Walter Heape speaks of the "errant nature" of the male, which constantly suggests to him the attraction of a strange female. He contrasts the roving tendency of the male, ever intent on the appeasing of his sex hunger, with the much more stable female, whose

sex impulse seeks satisfaction rather in the offspring resulting from the sex process, thus supplying the main impetus for the establishment and consolidation of family life. This antithesis between the male and female expression of the sex instinct he would regard in the light of a biological law of Nature. A similar view is also taken by Professor W. Thomas, who states that "from the biological point of view monogamy does not, as a rule, answer to the condition of highest (sex) stimulation." Havelock Ellis, too, admits man's "mysterious craving for variety," which pursues him right into his married life. For we cannot avoid the unpleasant truth that irregular sex habits are not confined to the unmarried only. Among the clientele of prostitutes a good proportion—and by no means the smaller one—are found to be married men.

The upholders of the ascetic ideal are here faced with a fundamental fact of sex life which no cavilling will avail against. Indeed, the problem of abstinence from this point of view becomes insoluble. Instead of asking the question whether abstinence is possible, it would be much more pertinent to ask whether, if possible, it would be good. Traditional opinion looks too much upon the sex impulse as a separate phenomenon of human life which may be disregarded at will until such time as it can find proper expression in a legalised form. According to the prevailing notion, the current of sex life may be dammed up without detriment, personal or social. It assumes that the floodgates only need to be released at the appointed moment in order to yield a full and deep stream of emotion. But holding up too long love's vitalising power may lay barren the whole personality. We cannot shut out the most potent energising factor of life without at the same time stunting the emotional and spiritual capacity of man. The development of the

sex impulse is closely bound up with the mental growth of the individual, and its persistent disregard may cause what Nystrom has so well termed a veritable "atrophy" of personality. As Havelock Ellis has pointed out: "Even if sexual relationships had no connection with procreation whatever, they would still be justifiable, and are, indeed, an indispensable aid to the best moral development of the individual; for it is only in so intimate a relationship as that of sex that the finest graces and aptitudes of life have full scope." The baneful effect of a sexless life is seen in its worst form in spinsters who, doomed to a lifelong solitary existence, so often become starved in emotion, cramped in outlook, and soured in temperament.

Abstinence, then, which does not allow for the natural growth of the erotic emotions, far from being a true ideal, must be condemned at best as an "empty virtue." Indeed, the idea of sexual abstinence is an ill-conceived notion which cannot be sustained either on physiological or on spiritual grounds. It is based on a false conception of sex morality which regards physical sex relationship as intrinsically low and brutal. We have, however, found, firstly, that the sex instinct is as natural as any other fundamental human instinct; and, secondly, that the erotic emotions form the proper basis of even the noblest and truest love. We cannot starve the one without at the same time preventing the blossoming of the other. In order, therefore, to arrive at a right solution of the problem of continence, we must recognise both these factors. Only a combination of both these vital elements will give us proper guidance towards a true sexual norm. Continence, instead of aiming to miss love, should rather be a disciplined cultivation of love. It is self-control which forms the central idea of chastity. As Ellen Key has so well defined it: "Chastity is harmony

between body and soul in relation to love." And this harmony can only be attained by not unduly stressing either the physical or the spiritual side of love. Spiritual love without eroticism is meaningless, while, on the other hand, physical lust without the wider psychic irradiation of love is not only devoid of a real human content, but ends by defeating itself. For sexual passion, by overstepping its proper aim—the attainment of complete unity with the beloved—soon surfeits itself and gets wrecked on its own boulders. A sane use of the gifts given us by Nature, in sex matters as much as in other relations of life, is the only wholesome rule of conduct.

2. *SEXUAL HYGIENE.*

When we come to consider the application of the rule just enunciated, in the light of sexual hygiene, we are at once confronted with a great difficulty. For while the sexual norm must be based, in the first instance, upon physiological considerations, it does not follow that sexual behaviour can be determined on that ground alone. We have already had occasion to remark that sexual conduct must be in harmony with the social code of morality. Now, the latter imposes certain restraints upon the individual which are not always in conformity with the natural promptings. We cannot here enter into a detailed discussion of these alternative claims, but shall only lay down certain rules which may be accepted as the minimum demands of sexual hygiene.

It will be convenient to deal with our subject in two sections, treating separately continence before and after marriage. This distinction is not made so much because there is any difference in the sex impulse of the unmarried and the married, but because social considerations imply certain modifications in the conduct of unmarried people which do not apply in marriage. The wedded

state offers the possibility of sexual satisfaction under conditions which cannot easily be matched outside it.

Coming, then, to the discussion of continence before marriage, we may consider total abstinence an unquestionable rule in the early years of adolescence. Not only are the first sexual promptings undirected and immature, but they are often aroused prematurely by artificial overstimulation. To keep these youthful ebullitions under proper control, and to direct them into a wholesome channel where the spirit of romance and adventure may find an adequate outlet, is the task of all good education. Unfortunately, sexual maturity is generally reached by the average youth before his full mental and moral development, with the result that opportunities are eagerly sought after, before a proper valuation of the sex act is at all possible. The lighter forms of sex indulgence, flirtation, etc., would seem to a large extent unavoidable, as they constitute, so to speak, a sort of apprenticeship for the most difficult art of love. It is the facility of mercenary love which is the greatest danger besetting the path of unexperienced youths. Men generally find in prostitution the readiest means of sex gratification, and regard it as entirely natural in the sense that it relieves the sexual tension. Apart from any moral considerations, with which we are not strictly concerned in this book, the act of prostitution fails to satisfy the sexual norm simply because it does not fulfil the canon of chastity. Mere sensuous sex pleasure, divorced from all the higher feelings of love, can only be denoted as a falling away of man from all that is best in him. In this connection we cannot do better than quote the words of Edward Carpenter, who writes: "There is a kind of illusion about physical desire similar to that which a child suffers from when, seeing a beautiful flower, it instantly snatches the same, and destroys in a few moments the form and

fragrance which attracted it. He only gets the full glory who holds himself back a little, and truly possesses, who is willing, if need be, not to possess."

Self-control, then, is here identical with abstinence. This is the more imperative, as prostitution harbours the danger of disease, which, by attacking its votaries, undermines their health, and often that of their future mates and progeny. We refer, of course, to the scourge of venereal disease which is such a constant companion of promiscuous sex relationship.

The venereal diseases are due to specific microbes, and are therefore contagious. Though commonly transmitted from person to person by intimate sexual contact, they can also be communicated by the usual channels of infection, as by contaminated vessels, towels, etc. Thus, on the one hand, innocent people and children may acquire the disease through no fault of their own; while, on the other, protection against the disease-producing microbes by antiseptic means may insure safety against infection without at all altering the conditions of sex relationship. These facts should be a sufficient refutation for those people—if there are still any left—who believe that venereal disease is the natural result of illicit intercourse, a Divine punishment for sinful sex relationship.

Of the three sex diseases—gonorrhœa, syphilis, and soft chancre—the last named is the least dangerous, as it only causes a local sore at the point of infection, which is curable in a short time. Gonorrhœa, which produces an inflammatory discharge of the genital passages, is more serious, as it often spreads upwards into the urinary system. In woman it may produce inflammation of the uterus and its appendages (tubes, ovaries, etc.). It can, however, have still more serious general effects by attacking the joints, the heart, and other internal organs. As the disease often leads to permanent pathological changes

in the main sex organs, rendering them functionless, it is one of the most frequent causes of sterility in man and woman. Apart from the genito-urinary tract, the mucous membrane of the eyelids (conjunctiva) is especially susceptible to the virus of gonorrhœa. The eye may become severely inflamed, the disease not infrequently resulting in impaired vision or even blindness. Unfortunately, this danger may threaten innocent babes whose eyes become infected, during birth, with the purulent vaginal discharge from their diseased mothers. A great many cases of lifelong blindness are due solely to this cause. Of the three diseases mentioned, syphilis (or specific disease, as it is also technically called) is the most obstinate, and at the same time the most disastrous in its consequences. Beginning with a local sore (hard chancre) at the seat of infection, it invades the whole system, and may attack during a number of years nearly every organ of the body in turn, often producing most extensive degenerative changes. Even after having been quiescent for long periods, it may flare up and produce ulcerations, paralysis, and even paralytic dementia. The general treatment of the disease must be extended at least over three to four years, if it is to produce any good results at all. But this is not the worst. The disease is inheritable by the offspring, who, being born with innate syphilis, suffer from congenital weakness and other serious affections, which rob them of life's blessings from the very start of their career. As syphilis is practically an unfailing cause of abortion in women, it is one of the most potent factors of sterility.

If we are now asked up to what age abstinence should be practised, we can only give an approximate reply; for it is impossible to generalise in a matter where we meet with so much individual variation. On the whole, it may be said that every earnest youth can, if he would,

preserve his bodily purity at least up to the age of twenty-one. After this it becomes increasingly more difficult for individuals with ardent natures, though it is not entirely impossible. With women the problem of abstinence is, on the whole, much less urgent, as their sex passion, if not prematurely aroused, awakens much later, and is even then generally not quite so volcanic. How to solve the problem of abstinence for those who by ill-luck are forced to prolonged, if not lifelong, celibacy is a matter for the social reformer. All we can say here is that a society which imposes upon a large proportion of its members the futile task of dispossessing themselves of Nature's most precious gift fails to fulfil its most vital aim.

Sex behaviour in marriage would appear, at first thought, to need no special discussion. Indeed, young people during the first glow of their honeymoon enter upon their conjugal career with a light heart, trusting to the adage: "All is fair in love and war." No special instruction is thought necessary in order to guide them on their perilous love voyage, on which so many young couples have suffered shipwreck. The generally prevailing belief still is, that married life implies conjugal "duties," which are understood to mean the exercise of the most primitive sex function, the unavoidable congress, as a means for the procreation of the next generation. Such a marriage may be a good institution for the production of offspring, but it certainly is not an affair of love. As Havelock Ellis has emphasised: "Marriage and procreation are based on the erotic life"; for "love craves the flesh." We cannot exalt the one and degrade the other. And we have seen that love requires a continuous courtship, which does not cease with the consummation of the wedding night. It is love which keeps alive the feeling of mutual trust and friendship, which cements

marriage into a spiritual bond, and which finds its ultimate consecration in the child. As Edward Carpenter so well puts it: "He is indeed a master of life who, accepting the grosser desires as they come to his body, and not refusing them, knows how to transform them at will into the most rare and fragrant flowers of human emotion."

Accepting, then, the statement that conjugal congress is not merely a fertilising process, and can therefore not truly be limited to such purposes only, we come to the reverse side often presented by certain marriages. Here we have exorbitant demands made by salacious man in disregard of the strain imposed upon subservient woman. Though it is true that woman becomes much less exhausted by a succession of orgastic acts than her male partner, this is true only when they are entered into with the ready assent of mind and body. As a matter of fact, outrage and rape do not necessarily form a feature of extra-marital sex relationship only. Sexual intercourse loses all its human qualities when not carried out under proper conditions of love and courtship. The legal marriage tie in itself alters nothing in this fundamental psychological fact.

It would be futile to try to give any definite rules as to conjugal conduct. Temperament, inclination and ideals vary too much to allow of any fixed norm being laid down. The discrepancies arising in married life through the conflicting tendencies of the male and the female sex impulse can only be resolved by mutual forbearance and loving appreciation of each other's needs. There is no fixed breeding season in man which keeps in abeyance the sex impulse during the intervening periods, as in animals. In woman, as has been pointed out before, sexual desire frequently coincides with the time of menstruation. While old ideas of taboo and

æsthetic considerations would seem to tell against sexual intercourse during this period, it cannot be absolutely condemned on hygienic grounds. Impregnation at such time, especially during the later days of menstruation, is certainly possible. The male sex impulse, apart from natural fluctuations, knows no "close time." It is, therefore, the more imperative that proper regard be taken of woman's condition when once she has become the bearer of human life. Though it is hardly feasible under modern conditions to interdict sexual intercourse altogether at this period, it certainly requires much greater gentleness and care than at other times. This applies especially to the later months of pregnancy, and still more in those cases where there is a tendency to miscarriage. Nor must it be forgotten that the bearing capacity of woman is not unlimited. Procreation has come to be regarded, of late, from a higher point of view. Motherhood cannot be looked upon any longer as a mere physical process, but implies, according to the highest and best ideals, a spirituality which is only attainable if woman, not exhausted by the breeding process, is allowed to develop her full personality. To enhance each other's individuality in the conjoint life, to raise the erotic life to the highest level of human love, is the most glorious achievement attainable by Man as a sex being.

CONCLUSION

We have reached the end of the survey of our subject. Two points will have become clear from this discussion. The first is, that the erotic life of man, even the highest expression of it, stretches back with its furthest rootlets to the primitive sex impulse as found among the animals. The physical basis of sex, though overlaid with a magnificent structure of the human mind, is thereby not made dispensable, but, on the contrary, forms the necessary stable foundation of all human love. The second fact elucidated is, that there exists an inherent opposition in the character of the male and the female sex elements; that, while the former tends to be katabolic, active, restless, and aggressive, the latter is more anabolic, passive, stable, and submissive. This difference of the male and female sex characters has been traced right through the physical and psychic sex constitution of man and woman. Its influence makes itself felt not less in the domain of sexual hygiene, where it creates the serious problem of continence outside and inside marriage.

But the potency of this primitive sex antagonism is still more felt in the practical and social sphere of sex. According to Walter Heape, it is the male who, with his roving and changeable nature, is responsible for the custom of exogamy, or marriage outside the clan; while the female, always more a mother than a wife, has been

the founder of the family, ever constituting its main prop. The problem has remained very much the same up to modern times. Thus, prostitution and venereal disease depend largely upon the male sex factor, while illegitimacy and limitation of births are typical examples of the female sex problem. Now, the physiological and psychological facts of the sex impulse form, of course, merely a substructure of the great social fabric of sex relationship. This builds itself up in its main outline according to the great fundamental laws of sex. Social factors, the outcome of the blind forces of human nature, merely modify such structure to a certain extent, giving it the various shapes and expressions we find among various peoples. This has been the course of the evolution of sex relationship up to the present day.

But now the movement has entered on a new phase. Man has become self-conscious. Progress, instead of being left to run its course blindly, has become a deliberate idea of man. Through this very thought he has acquired the power of directing his own upward destiny. The whole feminist movement is an expression of this new impetus for progress. It aims at correcting the inherent weaknesses of sex, at reconciling the sex antagonism rampant in Nature. The old problem of Adam and Eve has acquired a novel aspect; suggestions and ideas for reform pour in on all sides and are eagerly discussed. A new world is surging to be born from out the womb of sex, the life-giver. The old opposition of male and female, irreconcilable in its primitive form, assumes a higher aspect, and is taken up in the synthesis of a new sexual order. In the words of Edward Carpenter: "The sexes, instead of forming two groups hopelessly isolated in habit and feeling from each other, rather represent the two poles of *one* group, which is the human

race." It is from this standpoint that a new society will have to shape itself in the reconciliation of the warring claims of man and woman. How to adjust the rights of man and woman outside and inside marriage, how to apportion the respective duties of husband and wife, of father and mother: this is the task of Sexual Ethics.

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